AutoCut

Model X5

User's Manual

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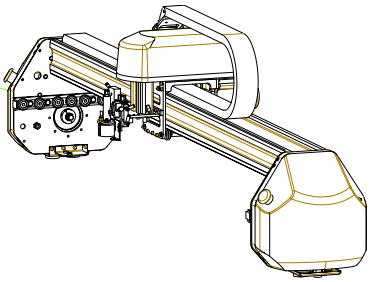
Chapter 1: System Summary

Your AutoCut X5 system consists of a vacuum table with integrated linear support rails, a lightweight carriage and cutting head, an electronics cabinet, cables, and a control station. You control the X5 cutting system with a virtual keypad in PatternSmith, accessed from the touch screen PC at the system control console.

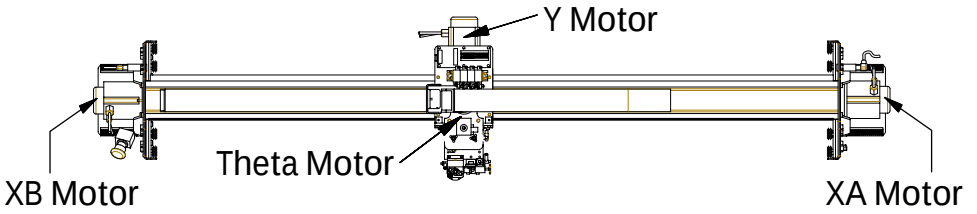
Carriage

The AutoCut carriage is made of aluminum and carbon fiber for the lightest possible weight. The lighter weight reduces forces on the system; this means your system will suffer less wear and will have improved reliability.

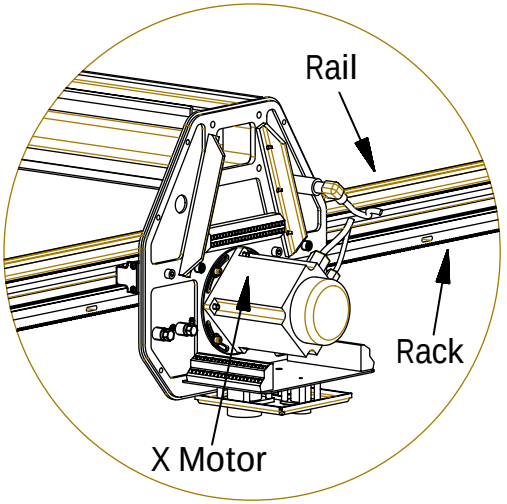


Motors

The AutoCut carriage has four motors. Two drive the X-axis (the length of the table), one drives the Y-axis (the width of the table), and one steers the cutting blade, called the Theta axis. The X- and Y-axes are driven by a pinion attached directly to the motor shaft.



Rails and Rack



Both X- and Y-axes use a rack and pinion drive. The racks themselves are oriented in an inverted position (teeth down) so that dirt, dust, and cutting debris cannot collect in them (this could cause cutting inaccuracies or create excessive drive resistance).

Attached to the vacuum panel edges are the X rails, structural members that provide linear accuracy along the X-axis. It is important to avoid subjecting the rails to excessive force that could distort them.

Limit Sensors

The cutting system uses six limit sensors. Three of these sensors are located on the table rails, and are used to define the X-axis limits at the ends of the table. These limit sensors are called XA Low, XB Low, and XA high.

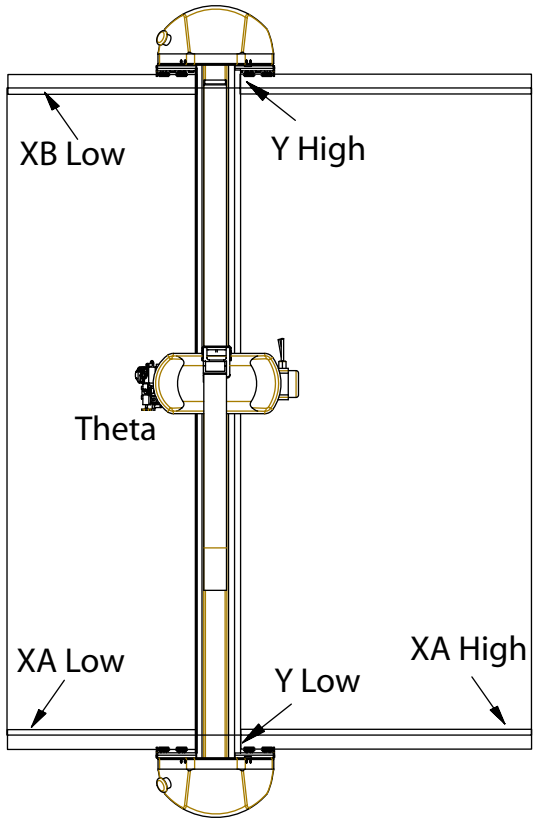
The remaining three sensors are mounted on the carriage assembly. These limit sensors are called Y Low, Y High, and Theta. You can view their locations on the diagram shown.

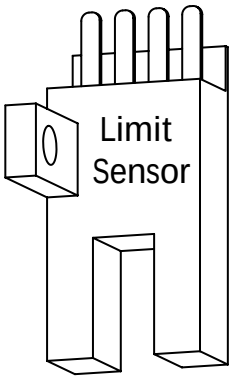
All six of the limit switches serve two purposes. First, they are used in the process of finding the 'Home' position and making the carriage square to the table each time it is powered up. Second, the positions of the limit switches and triggers define the "in bounds" rectangle of maximum carriage motion. If the carriage exceeds the range limits set by the sensors, the limit switches signal the controller to stop the

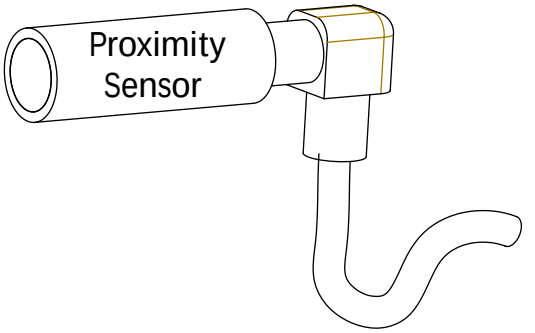
carriage immediately.

The Theta limit sensor, located on the carriage and used only for homing and for aligning the Theta axis, operates by emitting a tiny infrared beam, which is made or broken by a metal trigger mounted in the top gear of the cutting head.

The other limits are proximity sensors, and are triggered when a steel object comes within 0.15" of them.

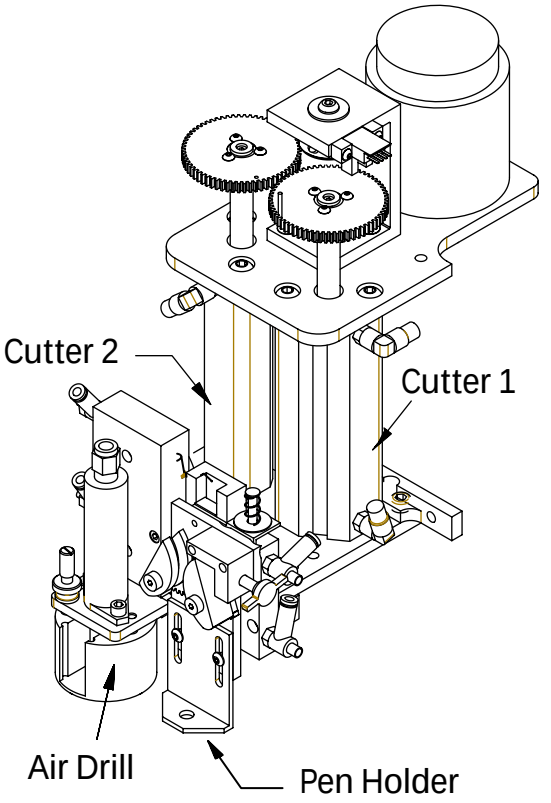


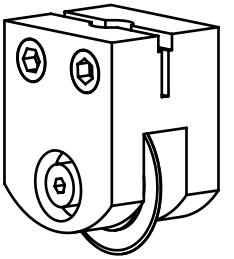




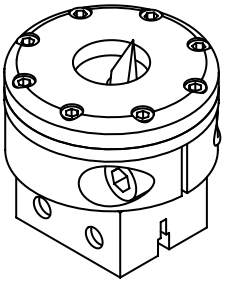
Cutting Head

The cutting head includes a pen holder, two steered blade holders, and an optional air drill. The blade holders can accept two types of rolling blades, tangential blades, a rotary punch, or a notch tool. The pen and blade holders are actuated by adjustable pneumatic pressure.





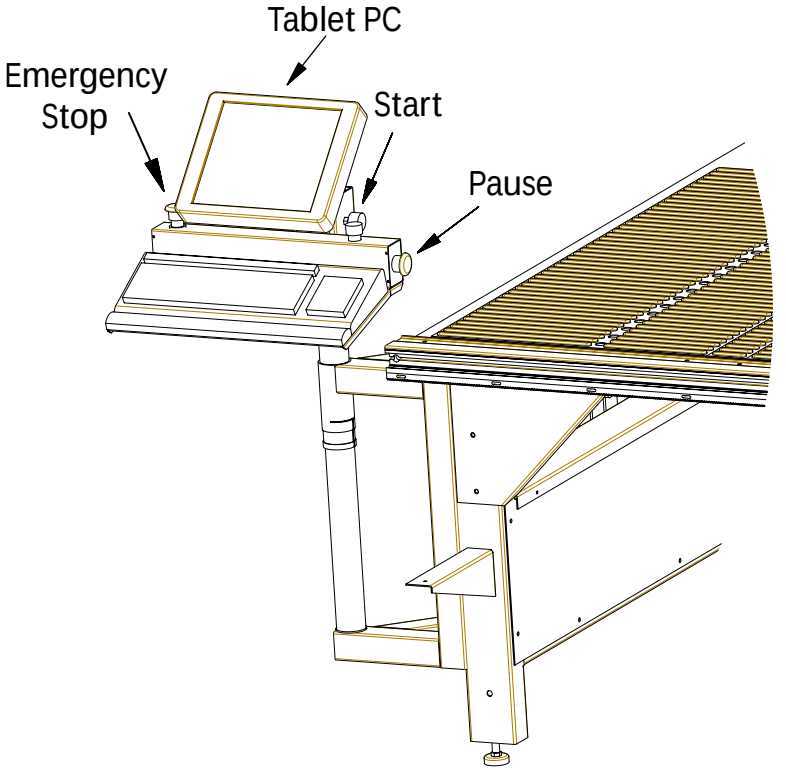
Rolling Blade Holder



Tangential Blade Holder

Control Console

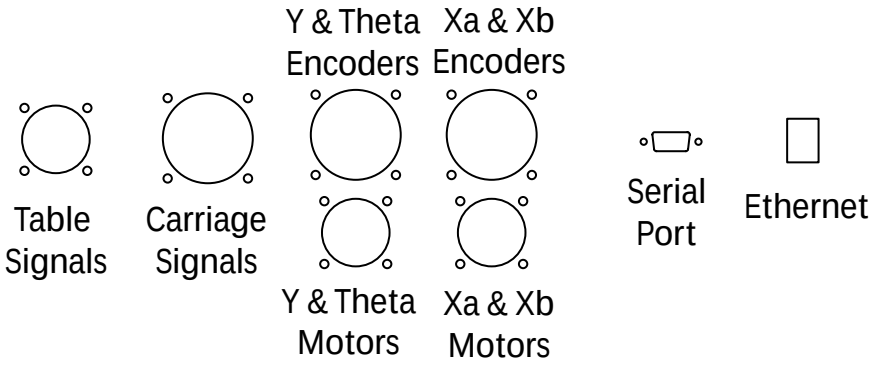
The Control Console is located at the origin corner of the table. It features a handheld keypad, start, pause, and emergency stop buttons, and space for you to insert your personal tablet PC, notebook computer, or monitor and keyboard. The Handheld Keypad, one of your primary controls throughout the cutting process, is docked at the control console; however, you can lift it out of its holder for convenient mobility. You'll find more information about the Handheld Keypad in Chapter 4: System Operation, and more information about the Start, Pause, and Emergency Stop buttons in Chapter 6: Plotting and Cutting.



Electronics Cabinet

The electronics cabinet contains the power supply, controller, interface boards, and drive amplifiers for each motor. The controller receives instructions from PatternSmith and translates them into the signals that position the carriage and cutting head. The electronics cabinet is connected to the Control Console computer using a direct crossover Ethernet cable. Alternatively, you can connect to your Local Area Network, or you can use a serial cable.

Electronics Cabinet Back



Cables

All moving cables for the X- and Y-axes are enclosed in the Energy Chain (E-Chain). The system is equipped with Continuous Flex cable, which will last for many years. However, in case of a need for maintenance, the E-Chain snaps open for easy replacement of cables.

Vacuum Table

The vacuum table is constructed from pultruded fiberglass panels, making the table design very rigid. These fiberglass panels are supported by a steel frame table base. The vacuum blower applies

suction to the entire table, evenly holding your material in place during the plotting and cutting process. (Additional vacuum blower assemblies may be needed for cutting tables longer than 40 feet.) Valves can be added to the vacuum piping, allowing you to use a reduced portion of the table for smaller cutting jobs. The vacuum blower assembly can be positioned either under the cutting table or at a remote location to eliminate noise in your workplace. Noise buffers can also be placed around the vacuum blower.

Cutting Surface

The cutting surface is constructed of a continuous flat sheet of polycarbonate plastic (Lexan). Small diameter holes are evenly spaced over the cutting surface. The free-floating Lexan cutting surface is placed over the "peak and valley" vinyl vacuum panel surface. Allowing the Lexan cutting surface to float freely over the vacuum panels eliminates problems that could be caused by thermal expansion. It also makes surface replacement quick and simple.

Attached to the vacuum blower is a vacuum relief valve. This provides airflow to cool the vacuum blower. **The maximum vacuum on the gauge should not exceed 110 inches of water.**

Chapter 2: System Requirements

It is important to make sure that your building's facilities meet the requirements mentioned in this chapter.

Power Requirements

The AutoCut X5 requires multiple power circuits to power the system components.

All electrical power sources and connections should be referred to a qualified licensed electrician before connection to the AutoCut.

There are three separate power requirements that must be met in order for the AutoCut to function.
Host computer:
    110 VAC, 20 Amp, Single (1) Phase
Electronics cabinet:
    208 / 220 / 235 / 240 VAC, 20 Amp, Single (1) Phase
Vacuum blower:
    220 / 440 VAC, 40 Amp, Three (3) Phase

Shielding Your Power Circuits

Care must be given to proper electrical routing and shielding. Shielding of power circuits is required. Without the use of separate conduits and the separation of single- and 3-phase power sources, signal interference may occur. To avoid the possibility of signal interference due to stray electromagnetic fields, the single phase power to the electronics cabinet, and the 3-phase power to the magnetic starters and vacuum blowers, should be run in separate conduit and kept at least 12 inches (30 cm) from each other. Whenever possible, avoid running power lines parallel to each other. The single-phase and 3-phase power sources must always be separate

circuits: 40-amp service for the 3-phase, and 20-amp service for the 110 and 220 VAC single-phase. Power to the electronics cabinet and the host computer should be line conditioned and surge protected to smooth power fluctuations.

Grounding Requirements

The braided grounding straps in each E-chain must be grounded to the table base. Each X-axis rail and the screen between the cutting surface and vacuum panels must also be grounded to the table. The table must be grounded to a ground rod or water pipe using minimum 4-gauge wire.

Power Conduit Layout

The host computer requires 110 VAC single phase power, on its own 20-amp circuit, conduit-shielded, line-conditioned, and surge-protected.

The AutoCut carriage and electronics cabinet need 220 VAC single-phase power, on its own 20 amp circuit, conduit shielded, line conditioned, and surge protected. From the main switch panel, the 220 single-phase power can then be routed via conduit, under the table and away from the three phase power line. It then routes to the contact box, mounted on the table frame at mid table in the immediate proximity of the electronics cabinet.

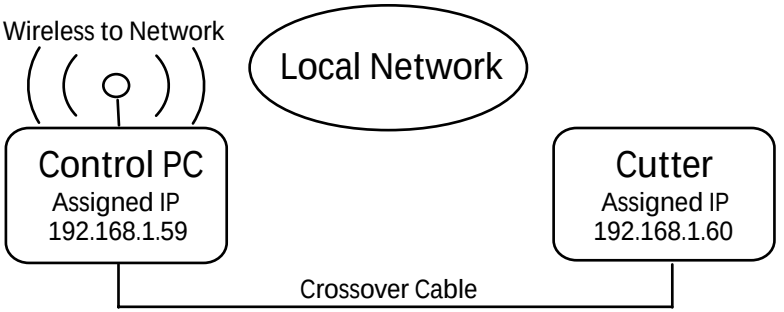
The blower assembly uses 220 VAC three-phase power on its own 40-amp circuit. This should be run in metal (shielded) conduit to a power disconnect and then to the main switch panel switching relays. The switched 3-phase power output from the power control relays should be routed underneath the table to each vacuum blower, using metal (shielded) conduit. This conduit is typically hard plumbed; however, the last 2 feet need to be flexible conduit to allow for minor adjustments in location of the blower assemblies.

Chapter 3: Network Connections

Before operating your system, you need to connect the Control PC running PatternSmith to the X5 cutter using a network cable. You will probably want PatternSmith to find the files to cut over a local network. You will have four options for making the connections, depending on the type of network you want to use.

(Note: Instructions for setting IP addresses and finding Ethernet connections are included at the end of this chapter.)

Wireless PC to Local Network; crossover cable from Control PC to cutter.



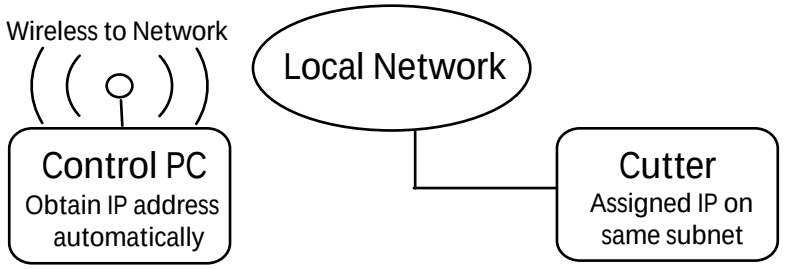
This option connects the Control PC directly to the Cutter using a crossover ethernet cable. It also connects to your local network through a wireless access point.

In order to use this option, you will need a DHCP Router with a wireless access point. The wireless access point can be plugged into your existing DHCP Router, or you can get a wireless DHCP router with an integrated switch.

You will configure the Control PC's Local Area Network adapter to have an assigned IP address with a subnet that is different from your LAN. Configure the PC's wireless adapter to get its IP address automatically from your router.

If you are using the optional Tablet PC, it will have a preset static IP address 192.168.1.59 and the Cutter will have a static IP address 192.168.1.60. If this is the same subnet as your LAN, it will need to be changed.

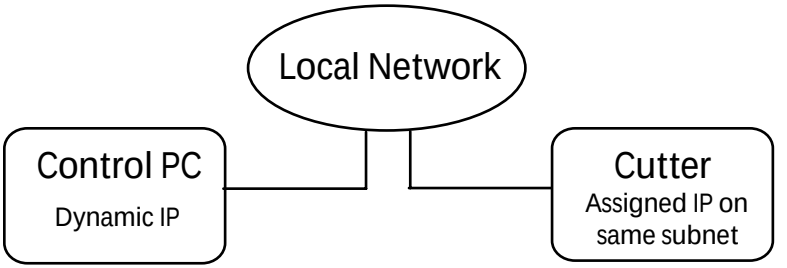
Wireless PC to Local Network; wired from Local Network to Cutter.



This option also requires a DHCP Router with a wireless access point, and allows any computer on your network to see the Cutter.

The Cutter will need to be assigned a Static IP address that will not conflict with your DHCP router. You can configure your router to reserve a range of IP addresses to be used as Static addresses. Assign an address to the Cutter that is within that range and on the same subnet. Then, let PatternSmith find the new connection address for the Cutter.

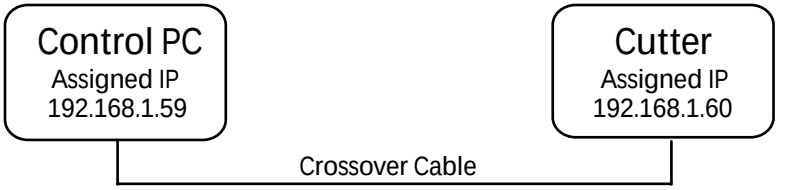
Wired PC to Local Network; wired from Local Network to Cutter.



This option doesn't require a wireless access point but still allows any computer on your network to see the Cutter.

Assign an address to the Cutter that works for your router. Then, let PatternSmith find the connection address for the Cutter.

No connection from PC to Network; crossover cable from PC to controller.



If there is no Local Network available, this option lets the Tablet PC see the Controller. Files can be moved to the PC using a Flash Drive or any USB mass storage device.

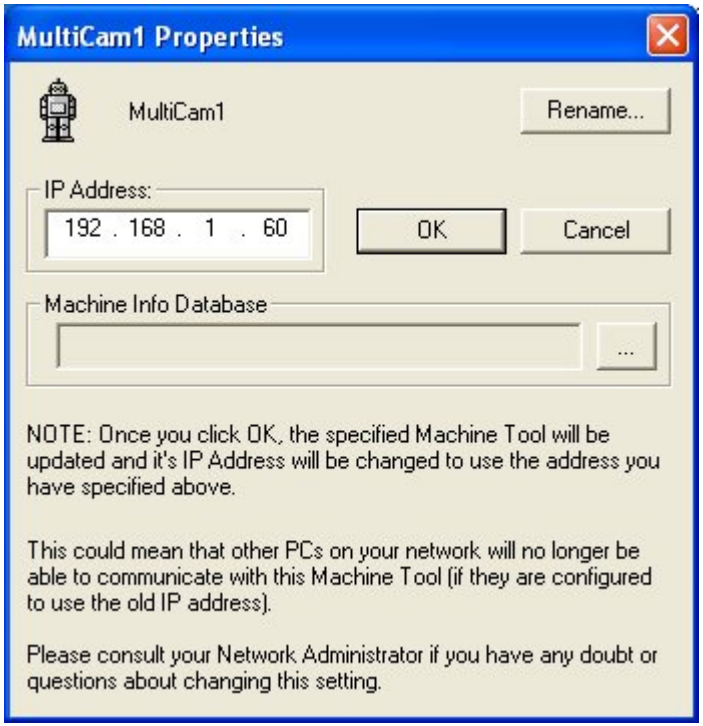
Setting Up Network Connections

To establish your network connections, first you need to set the Cutter's IP address.

Changing the Cutter's IP Address

When you install either Motion Mechanic or PatternSmith 2005, you will also be adding the Machine Tools applet to your Control Panel. If you need to reset the controller's IP address, start the Machine Tools applet from your Control Panel.

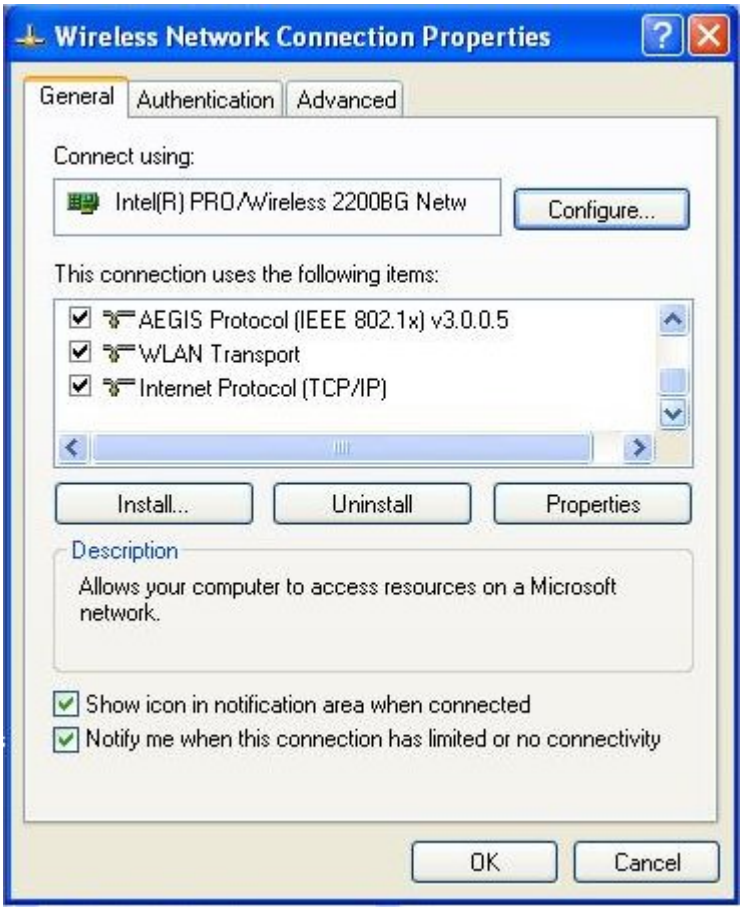
Select the Cutter's Controller (it will probably be the only one shown) and click Properties.


MultiCam1 Properties
MultiCam1
Rename...
IP Address:
192 . 168 . 1 . 60
OK
Cancel
Machine Info Database
...
NOTE: Once you click OK, the specified Machine Tool will be updated and it's IP Address will be changed to use the address you have specified above.
This could mean that other PCs on your network will no longer be able to communicate with this Machine Tool (if they are configured to use the old IP address).
Please consult your Network Administrator if you have any doubt or questions about changing this setting.

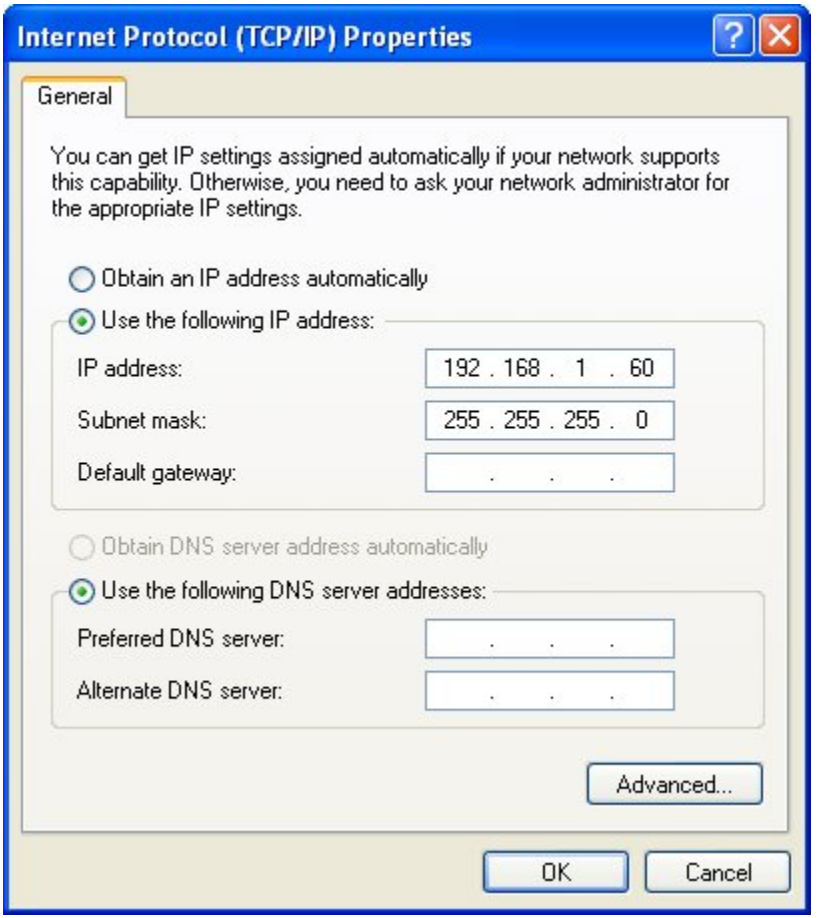
Enter the new IP address you want to use for the Controller, and click OK. Then you can test the connection from the previous screen by clicking Test IP.

Changing the Computer's IP Address

Each network adapter in your computer will have its own IP address. To change an IP address, first go to Network Connections from your Start button. Then right click on the connection you want to change and click Properties.

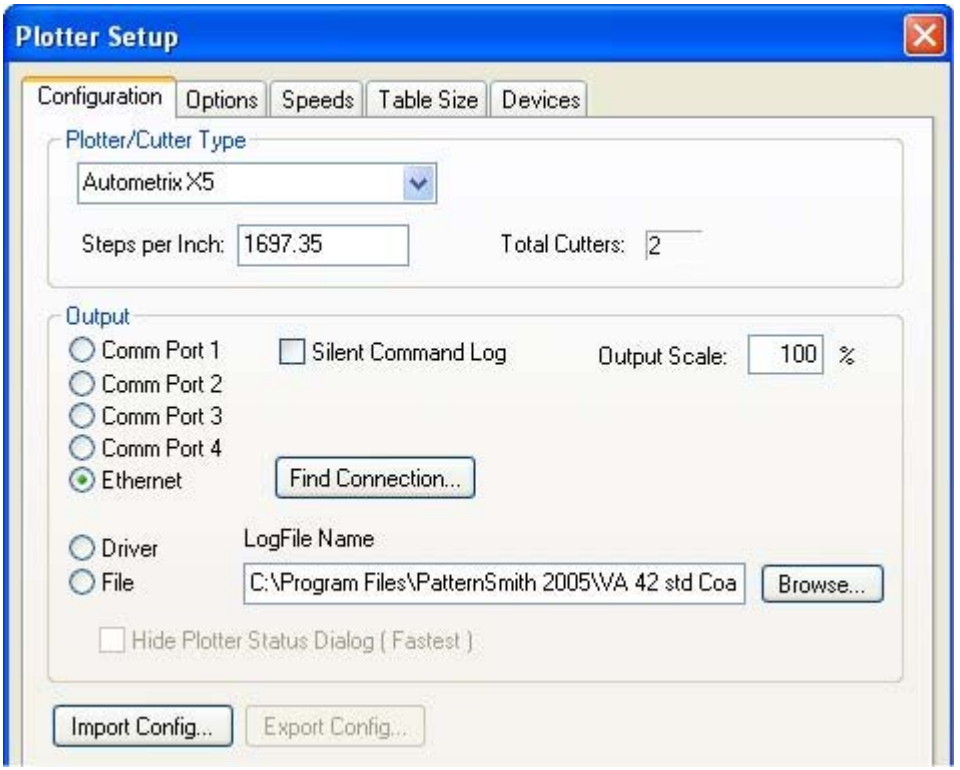


At the Properties screen, select Internet Protocol (TCP/IP) and click Properties. You can choose to Obtain an IP address automatically or set a static address as shown.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 1 . 60
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Finding an Ethernet connection in PatternSmith

From the PatternSmith Plotter Setup screen, click the Find Connection button next to the Ethernet radio button. You will see all of the available connection IP addresses. Select the one for the cutter, and click OK.



Chapter 4: System Operation

This chapter will guide you through operation of your AutoCut X5.

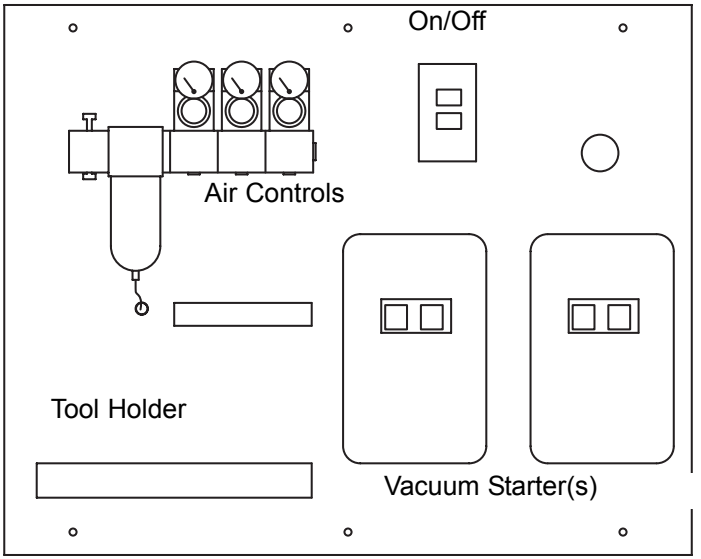
System Startup

Before you power up the AutoCut, make sure that:

- Both sets of motor and sensor cables are connected to the electronics cabinet and the carriage.
- The Control computer and the electronics cabinet are connected either to the network or to each other.
- The compressed air pressure is turned on.

After you've checked these three things, follow this startup procedure:

- Start your computer and open PatternSmith.
- Turn on the power to the cutting system using the On/Off switch at the Home end of the table. Notice that the Handheld Keypad starts automatically.



The Handheld Keypad

The Handheld Keypad is the control point for operating your X5 from the Control Console. You will use the Handheld Keypad to turn your vacuum blowers on and off, select your plotting or cutting device, prepare to change a cutting blade, and to home the cutting system. The Handheld Keypad also includes a screen that will provide you with information throughout the cutting process. This screen shows your current coordinates and will sometimes be used to display system messages or instructions.

The Virtual Keypad

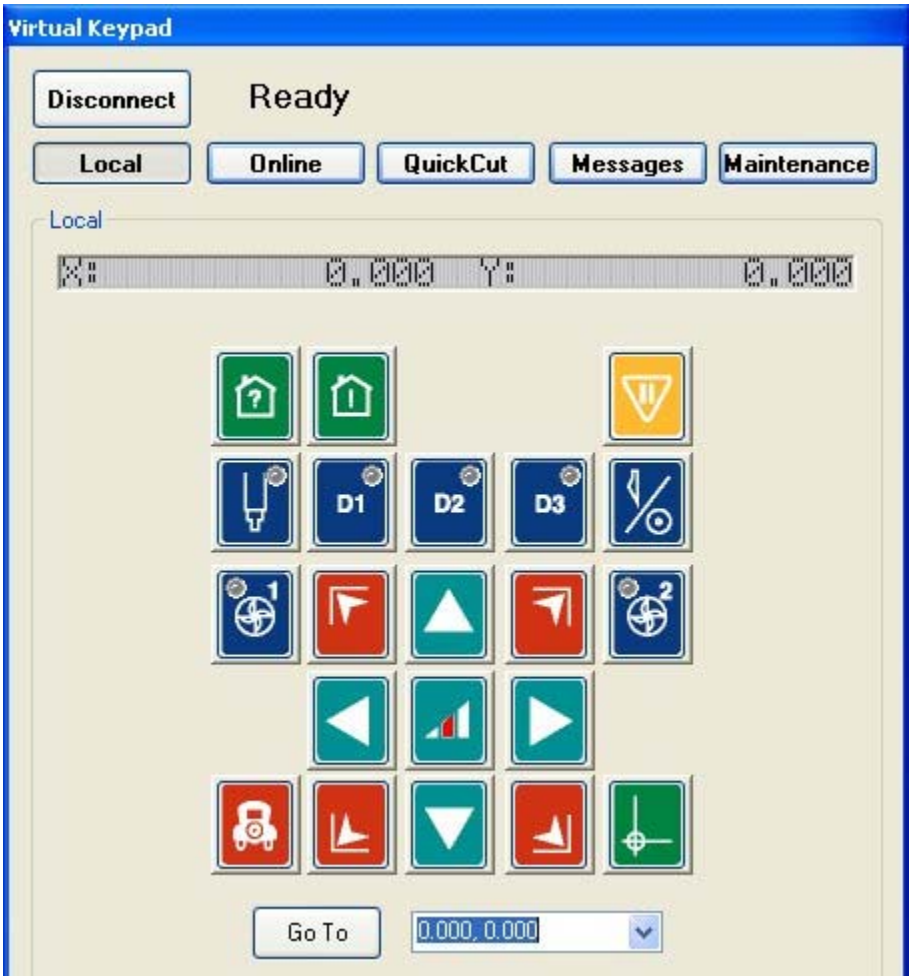
You can also control your cutter from the control computer. From the Plot menu in PatternSmith you can connect to The Virtual Keypad, the control point for operating your X5 from your PC, tablet PC, or notebook. The Virtual Keypad, when it is in Local Mode, offers you the exact same functions found on the Handheld Keypad. The Virtual Keypad also gives you access to four additional operating modes not found on the Handheld Keypad: Online, QuickCut, Messages, and Maintenance. Like the Handheld Keypad, the Virtual Keypad includes a one-line information bar displaying current coordinates and other pertinent information.

Local Mode and Finding Home

When you initially power up, the cutter will be in Local Mode. In this

mode, the operator is in control of the machine from either the Handheld Keypad or the Virtual Keypad. Here you can jog and home the carriage, and you can activate the pen and the cutters. The host computer cannot send plotting or cutting commands while the system is in this mode.

Local Mode



When you first power up the cutting system, the Handheld Keypad will turn on automatically and will instruct you to “Press Find Limits.” Press the “Find Home” button. The carriage responds by moving slowly in the negative directions along both the X- and Y-axes. When the carriage reaches the limit sensors, the carriage automatically squares itself to the table, setting the Y-axis perpendicular to the X-axis of the table. Next, it aligns the cutting blade to zero degrees, and finally moves to the Global Home (0,0) or Global Origin position, at which point it stops and awaits further instructions. The screen display will read x= 0.00, y= 0.00.

Local Mode includes many other comamnds you’ll use in the cutting process. The Go Home button can be used at any point. Pressing Go Home sends the carriage to its previous start point on the first press, and to the Global Origin (0,0) the second time it is pressed.

The Blade Change button can be pressed if you need to change your cutting head tool. You can do this at any time, either between cutting projects or by pausing your current project. This function moves the cutting head to Y=12 inches for your convenience, while the X value will remain in its current position. When you finish changing your blade, press the Blade Change button again, and the cutting head will return to its previous position to continue.

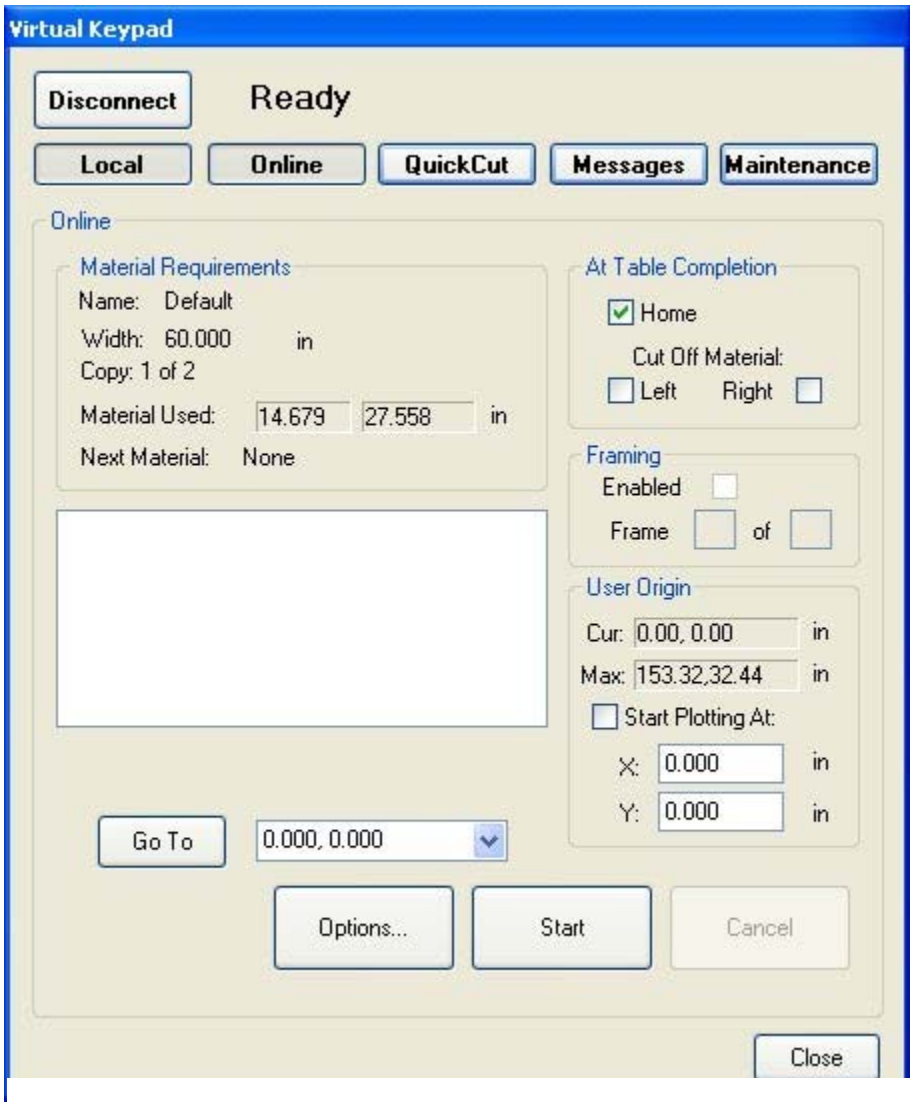
From the Virtual Keypad or the Handheld Keypad, you can also use the Device buttons to activate any device. There are four Device buttons: Pen, Dev 1, Dev 2, and Dev 3. Press the appropriate button to activate a device. A light will indicate that the device is activated. Pressing the button again will deactivate the device. Devices 1 and 2 are steered blade holders that can hold a rolling blade, tangential blade, notch tool, or punch. Device 3 is usually an Air Drill.

You can start your vacuum blowers from the Keypad or from the Mag Starter switch at the end of the table.

Use the Keypad to jog the carriage to any location you wish while you are in Local Mode. You can depress the Jog Speeds button to select low, medium, or high speed for jogging. Use the arrows to jog in the desired direction. The Jog Fast button combined with a jogging direction will allow you to temporarily jog quickly while the overall jog speed is set to low. During jogging, the display screen shows the present coordinates of the pen. Anytime you want to return to the Global Home position, simply press the 'Go Home' button. You can use the jogging arrows to select a start location other than the Global Origin to begin a cutting project. You can jog the carriage to any location, but be careful to ensure that the entire cutting project will still fit on the table!

Finally, the Red Park button is a new feature allowing you to "park" the carriage in any corner of the cutting table you choose. Simply press the Park button followed by the red corner button indicating the corner of the table you'd like the carriage to park in.

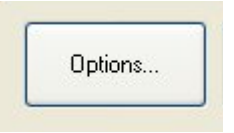
Online Mode


Virtual Keypad
Disconnect
Ready
Local
Online
QuickCut
Messages
Maintenance
Online
Material Requirements
Name: Default
Width: 60.000 in
Copy: 1 of 2
Material Used: 14.679 27.558 in
Next Material: None
At Table Completion
Home
Cut Off Material:
Left Right
Framing
Enabled
Frame of
User Origin
Cur: 0.00, 0.00 in
Max: 153.32,32.44 in
Start Plotting At:
X: 0.000 in
Y: 0.000 in
Go To
0.000, 0.000
Options...
Start
Cancel
Close

Once you have homed your system, you can switch to Online Mode. Online Mode allows you to send commands to the cutter for the current PatternSmith project. Online Mode relinquishes control to the host computer to execute PatternSmith instructions. You cannot jog the carriage while in Online Mode; however, you can still use the Go To function to enter precise coordinates for a starting location. Type a set of coordinates into the dropdown menu above the 'Go To' button. If you hit Enter, your typed coordinates will be saved in the dropdown menu for future use. After entering your coordinates, press 'Go To.' The carriage will move to the position you specified. The coordinates of the carriage will be reflected in the display screen at the top of the Virtual Keypad.

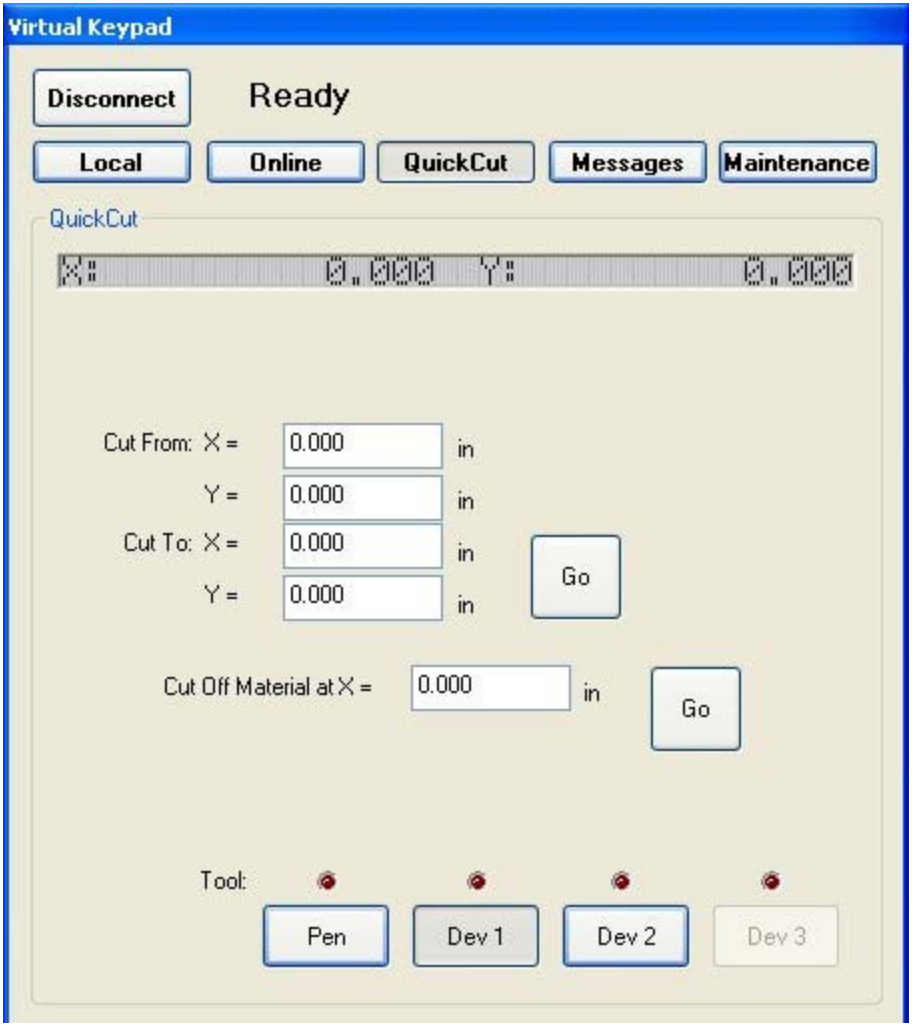
(Note: The Go To function is available in both Online Mode and Local Mode.)

In Online Mode, Plotting and cutting is done under host computer control. The Options button allows you to plot or cut your current table, current material, or all materials. (See the PatternSmith User Manual for more details.)



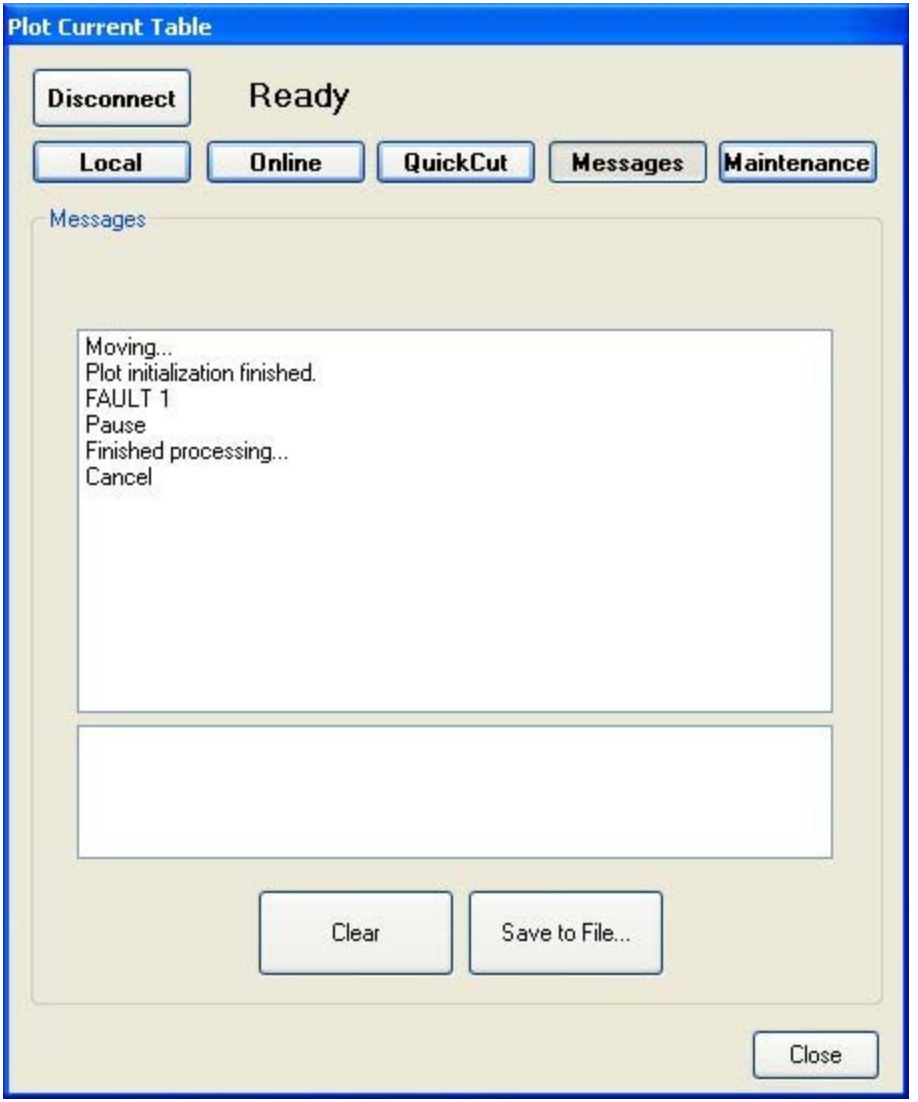
QuickCut

QuickCut is a convenient feature that allows you to make quick single-line cuts. Simply enter the startpoint and endpoint, select the device you wish to use, and press Go. You can also have your material cut off at a specific X coordinate.



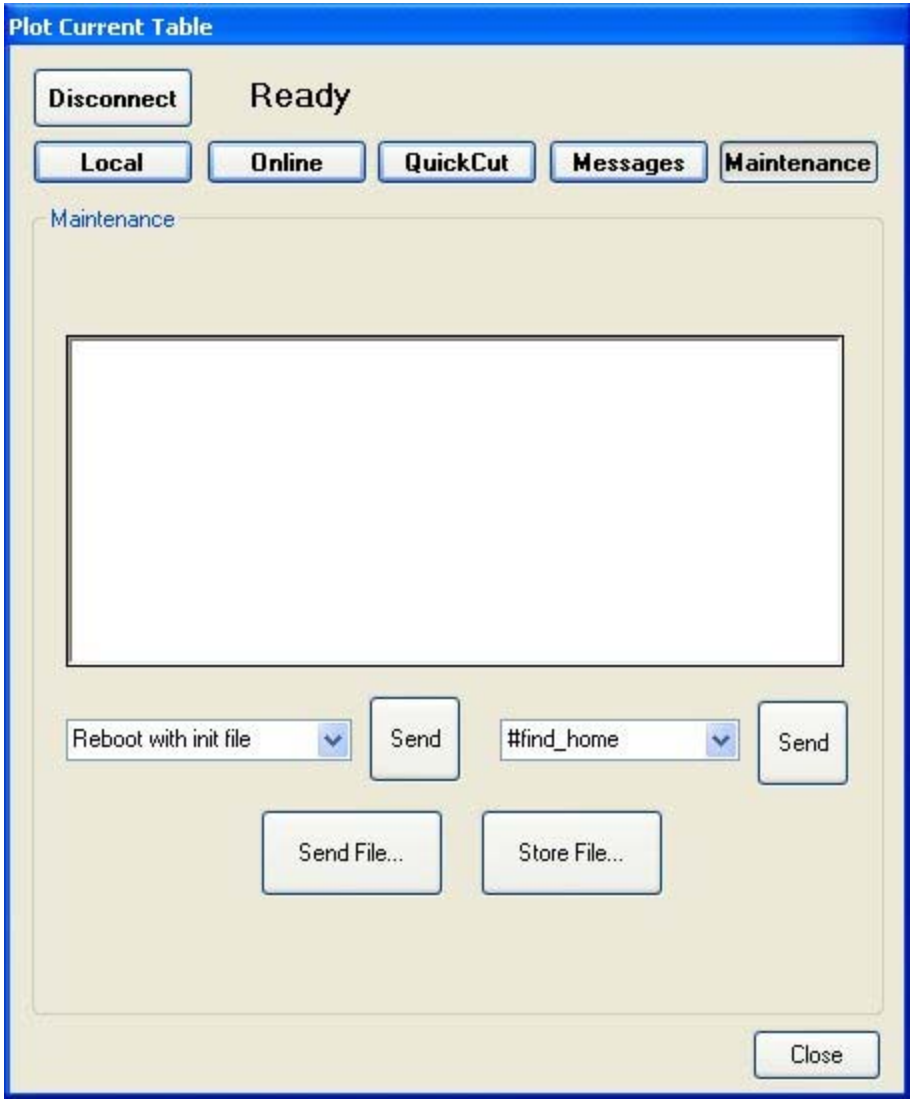
Messages

This window keeps track of all the messages the controller is sending back to the computer. This is often used for diagnostic purposes.



Maintenance

Pressing the "Maintenance" button gives you access to a screen where you can upload new firmware as updates become available. Here you can also do diagnostic testing.



Chapter 5: Plotting and Cutting Devices

The AutoCut features several different blades and blade holders.

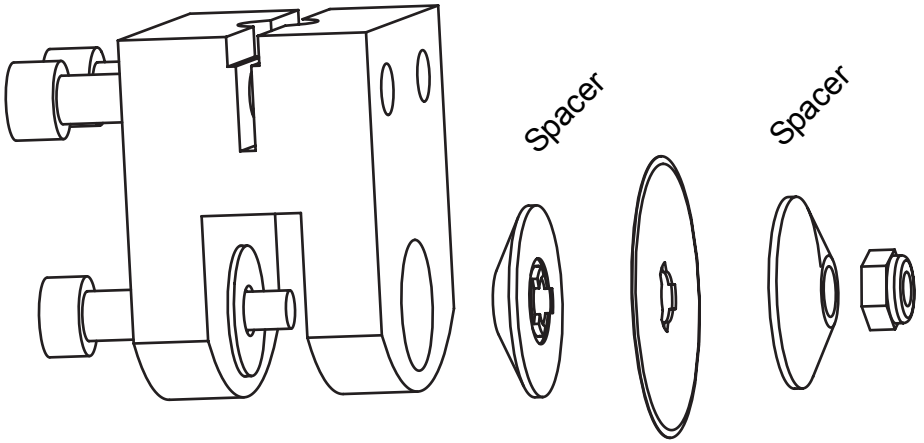
Blades and Blade Holders

The AutoCut has two steered blade holders. Each holder can accept a rolling circular blade, a tangential knife blade, a notching blade, or a hole punch. Select the rolling blade or the tangential blade based on the material and patterns to be cut. Most fabrics can be successfully cut with the rolling blade. Some "high density" materials, such as clear acrylics or Kevlar-reinforced materials, require the tangential blade. The rolling blade cuts a clean circle or radius down to about one half-inch radius. Smaller radii can be cut with the tangential blade. When cutting a new material, test both cutting devices to determine which will provide the best results.

Tell PatternSmith which blade you have in each device. From the Project Window, click Plot>Plotter Setup>Devices. Set the number of plotting or cutting devices in the Total Devices Selector box. For each device, select the blade type that you are using. With the optional air drill, an AutoCut can simultaneously carry four devices - pen, cutting blade, notching tool, and punch. On your pattern, set elements to Plot Type Cut1 or Plot Type Cut2 on the Attributes Toolbar in the Editor Window.

Changing Blades

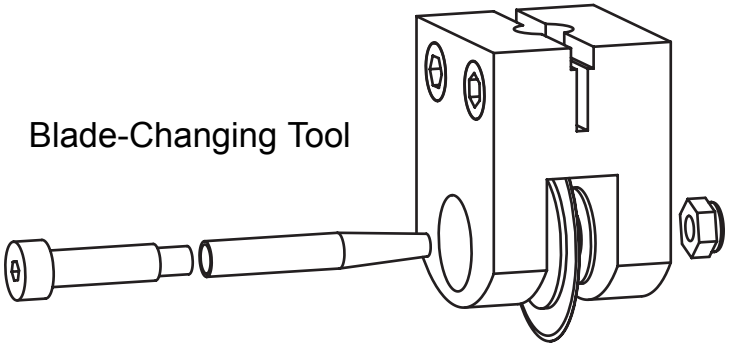
Change the rolling blade as shown in the diagram.



Note: Olfa blades and carbide blades use different spacers.

Olfa Blades

The Olfa blade uses two differently styled spacers. One spacer has three raised nibs around the center hole. The other has a recessed ring around the center hole. First, make sure the triangular center hole of the Olfa blade is nestled firmly onto the raised nibs of the



nibbed spacer. Then center the recessed spacer on the blade. Place the blade-changing tool on the end of the shoulder bolt. While carefully holding the blade/spacer unit between the arms of the blade holder, insert the narrow end of the blade-changing tool through the bearing, the blade/spacer unit, and the second bearing. Push the shoulder bolt through until it stops. (The blade-changing tool will drop off.) Attach the nut to the shoulder bolt.

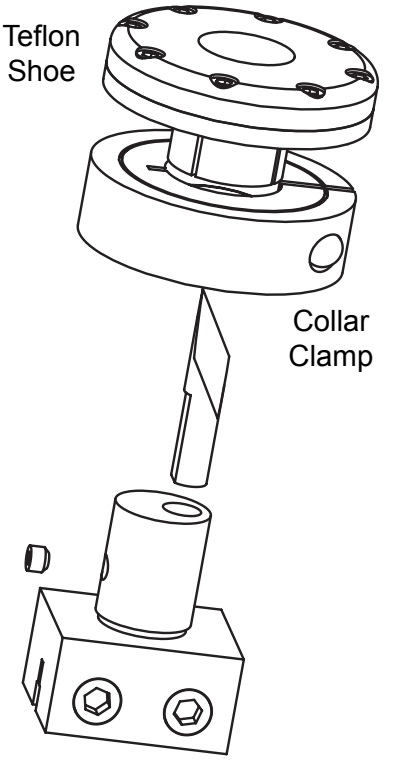
Carbide Blades

A carbide blade uses two identical spacers. Center the blade between the two spacers and then use the blade-changing tool to attach the blade/spacer unit, as described above.

Tangential Blades

The tangential blade is mounted inside a "shoe" that rides on the surface of the material being cut. The depth of blade, or distance below the shoe, should be set to a few thousandths of an inch more than the thickness of your material. Replace the tangential blade as shown: Loosen the collar clamp bolt with a 3/16" T-handled Allen wrench. Unscrew the collar clamp. Using a 5/64" Allen wrench, loosen the set screw that anchors the tangential blade. Replace the blade, making sure that the flat side of the blade post is facing the center of the blade holder. Tighten the set screw. Replace the collar clamp, screwing it on to the proper blade depth. Tighten the collar clamp bolt.

Tangential Blade Holder

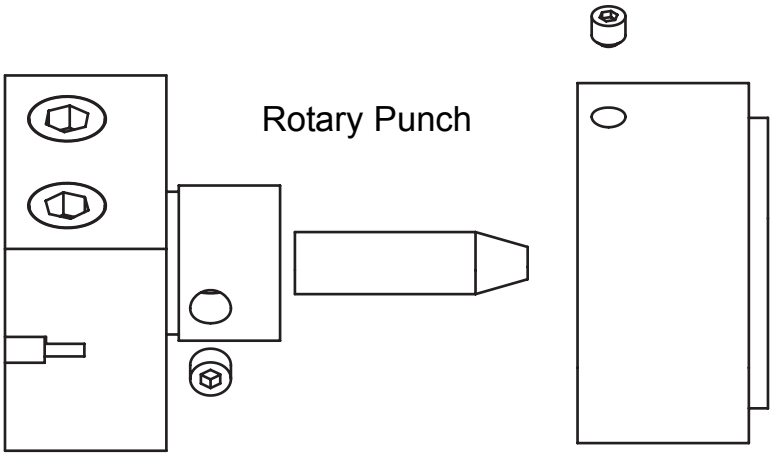


Notch Blade

The notch blade is mounted in the same style blade holder as the tangential blade. Replace the notch blade in the same way that you replace the tangential blade.

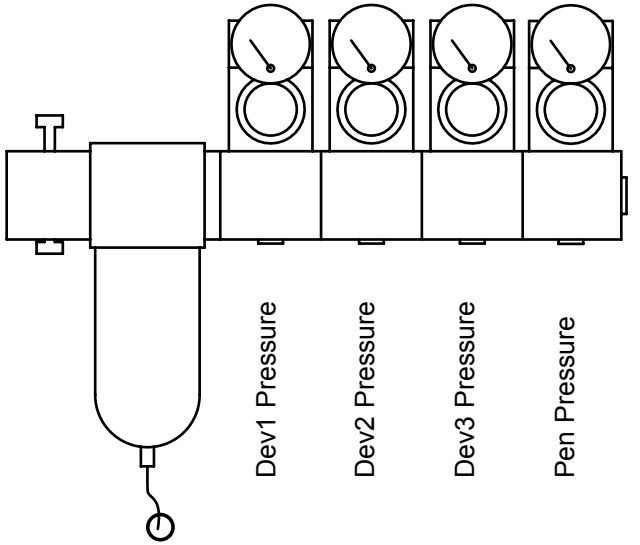
Rotary Punch

The rotary punch is mounted inside a rotating "shoe" which rides on the surface of the material being punched. Set the depth of blade below the shoe to a few thousandths of an inch more than the thickness of material to be cut. Replace the rotary punch the same way you replace the tangential blade.



Cutting Pressure

The cutting pressure adjustment is located on the table base, near the On/Off switch. With a sharp blade, most materials can be cut with the cutting pressure set between 20 and 35 PSI. Tougher materials may require up to 40 PSI. As the blade gets dull, you will need to increase the pressure. When the pressure gets to 50 PSI, it is time to replace your blade.



Blade Sharpening

Carbide blades for both the roller cutter assembly and the tangential blade can be re-sharpened several times. When you have collected a batch of 50 or more used blades, contact Micro 100 Tool Corporation (1-800-635-3080) for sharpening services. New blades can be purchased from an in-stock supply at Autometrix.

Pens and Pen Holders

The AutoCut features a pen holder that can accept most pens, up to one half inch (0.5”) in diameter. Different pens have different flow rates, which can vary considerably. Plotting speed is limited by the flow rate of the pen being used. Typical plotting speed is 15-30” per second. Autometrix recommends Fisher Space Pens for reliability and the most consistent flow.

Pen Replacement

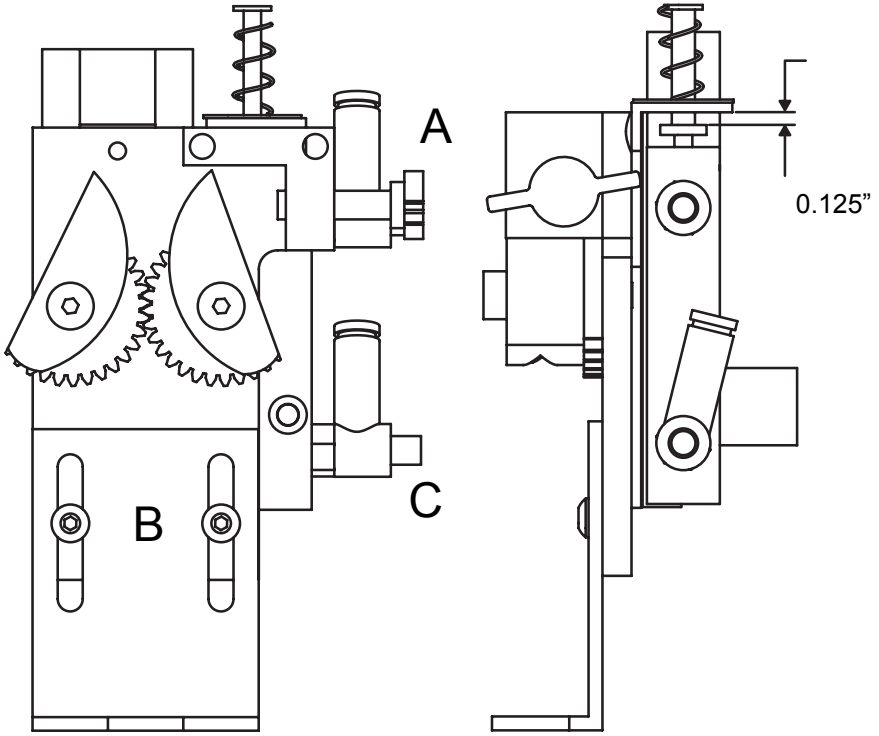
Loosen the adjustment bolt (marked ‘A’ on the drawing shown). Remove the old pen, insert a new pen, and tighten the adjustment bolt.

Height and Pressure Adjustments

Loosen the two bolts that allow the holding bracket to slide up or down (marked 'B' on the drawing shown). Move the bracket up for less spring pressure on the pen or down for more spring pressure. Adjust your pen to allow for 1/8" compression on the spring when the pen is in the down position. Tighten the bolts. Adjusting the holding bracket up and down allows for the use of pens with tips of varying length.

Pen Speed Adjustment

You can adjust the speed with which the pen moves down to the table surface. Insert a small screwdriver in the air valve (marked 'C' on the drawing shown). Turning the screwdriver counterclockwise will increase the pen down speed, and turning the screwdriver clockwise will decrease the speed.


A
B
C
0.125”

Chapter 6: Plotting and Cutting

Before plotting or cutting, you need to start PatternSmith and open the pattern or project you wish to plot or cut. Patterns are displayed in the top portion of the screen, while nested copies are displayed in the lower portion.

You can find complete instructions for using PatternSmith in the PatternSmith User Manual, PatternSmith Help Files, and the PatternSmith tutorial CD.

The first time you use PatternSmith, you need to establish your network connections, determine what blades are installed on the cutting devices, and determine the length of your table. Navigate to Plot > Plotter Setup to enter this information. See the PatternSmith User Manual for details.

The Vacuum Table

Next, you are ready to roll your material onto the vacuum table, smoothing wrinkles as much as possible. Make sure that all the holes on the surface of the vacuum table are covered by the material. If your material doesn't cover all of the holes, use a filler material to cover the open holes. Porous material must be covered with a plastic sheet to hold it firmly in place.

With your material in place, turn on the vacuum blower. The vacuum pressure gauge on the end of the manifold should read at least 30" of water. When all of the holes in the surface are sealed completely, vacuum pressure can rise to over 100". However, you can cut successfully with pressure as low as 25".

Local Origin

You can choose to start your plot or cut job from the global home position or from the Local Origin. Wherever the pen is located at the time that you press Start is considered the Local Origin. You can determine where you want the Local Origin to be; use the Handheld Keypad or the Virtual Keypad to jog the pen to the position you wish to make the Local Origin.

Plot Current Table

From the Virtual Keypad, press "Online" to change from Local mode to Online mode. A "Start" button is now displayed on the screen. (For safety reasons, PatternSmith requires that you be in Online mode to start the AutoCut.) Press "Start" on the Virtual Keypad. The green Start button to the right of the screen will light up. Confirm that you wish to start the cutting process by pressing this button. After a 1-2 second delay, the carriage will begin moving. PatternSmith will complete all plotting and cutting. The carriage will then return to the current Local Origin (or the Global Home position if you chose to begin your cutting process from there) and wait for your next command.

The Start Button

When you are ready to begin a cutting job, the Start Button provides an added safety feature. After you are in Online Mode and have pressed Start on the Virtual Keypad in PatternSmith, a green light will light up the Start Button on the top of the Control Console. You must confirm that you are ready to begin the cutting process by pressing this Start Button. This ensures that only an operator standing right at the Control Console can start the cutting job.

The Pause Button

At any point in the cutting process, you can pause the carriage by pressing the Pause Button. The Pause Button is a large lighted orange mushroom button, located on the right side of the Control Console. Two more pause buttons are located on each end of the carriage for added safety. When the carriage is in motion and under control of the host computer, pressing the Pause button will immediately stop the carriage. The system will remember where it stopped in the cutting process, retaining the information needed to resume cutting if asked. You can choose to resume the cutting process, cancel the current cutting job, or change blades. To resume cutting, simply press the Continue button. To terminate the cutting job, press the Cancel button.

The Pause Button is a safety feature, but it can also be used to allow you to change a pen or blade or to check cut depth. To change blades, press the Change Blades button. When you're finished changing your blade, if you are controlling your cutter from the Handheld Keypad, press the Change Blades button again. If you are controlling your cutter from the Virtual Keypad in PatternSmith, press Continue. The Pause Button is also a valuable means of quickly stopping the AutoCut carriage if a bystander enters its range of motion.

The Emergency Stop Button

The Emergency Stop (E-stop) is the large red button located on the Control Console on the left side of the Control Console. This is available for emergencies such as a broken blade or an obstruction on the table. When the E-stop button is pressed, all position information is lost. Turn off the power to the cutter and reset the E-stop button by turning it clockwise. Wait 15 seconds before turning the power on again. After you power up the cutter again, you will be able to resume cutting as usual.

Chapter 7: System Maintenance

The AutoCut carriage, x and y rails, rack, sensors, and pinions must be kept clean and free from any debris. The maintenance schedule is simple and, if followed, will ensure that your AutoCut provides you with many years of trouble-free operation.

PRECAUTIONS:

- Turn off power to the system before doing any maintenance.
- Never stand on vacuum table top.
- Keep material rolls off of the cutting table when the carriage is moving. If the carriage hits a roll of material (or other objects), it can cause extensive damage.
- Keep scrap or waste material from getting caught along the sides of the carriage or in the x-axis e-chain. Anything (material, plastic coverings, tape, etc.) that comes between the extrusions and the moving carriage may cause damage to the system.
- Keep all heavy equipment and supplies (forklifts, hoists, rolls of material, pallets, etc.) away from the table. Bumping the table with force can cause it to lose calibration or could cause severe damage.
- Protect the machine and yourself from static discharge with static mats and straps. Always ground yourself before you handle electronic components.

MAINTENANCE NOTE:

If the machine starts making an unusual noise, try to determine the source of the noise. This may be the first warning sign of a worn or damaged part. Replacing the part or returning it to Autometrix for repair may save you additional damage. Regular maintenance reduces down time and allows you to schedule that down time.

Maintenance Schedule

Daily (every 8 hours of use)

- Clean x axis rails. Debris will interfere with the system's performance.
- Clean x axis rack. Buildup of debris will cause premature wear on pinions.
- Clean y axis linear rail. Accumulated dust will cause unnecessary wear.
- Check cutting blade for wear. Dull or damaged blades reduce cutting efficiency and may cause unnecessary wear to the cutting surface.
- Check e-chain for material or obstructions. These can cause severe damage to cables and carriage.
- Clean the cutting surface by blowing it off with compressed air. This will help maintain vacuum pressure.

Weekly (every 40 hours of use)

- Check e-chain for debris, damaged cables, or overly twisted wires that can cause system down time.
- Wipe the x and y axis linear rails down with a drop of 3-in-1 oil on a soft cloth.
- Replace cutting blade. Sharp blades maximize cutting efficiency.

Monthly (every 160 hours of use)

- Check blade bolt. The blade should feel rigid, with no blade wobble.
- Inspect Olfa blade holder, if applicable. Blade should not move from side to side. If it does, replace the blade holder.
- Check x and y axis pinion gears. Pinion wear will affect the system's accuracy of movement. Adjust pinion engagement, if necessary, following instructions below.
- Clean system by blowing dust, lint, and material out of the carriage with compressed air. Clean the limit sensors with Q-tips so they are free of lint and dust.
- Clear the cutting surface holes by blowing them with compressed air. This will ensure good vacuum pressure.

Annually (every 2000 hours of use)

- Replace the rolling blade holder's bolt. Prolonged use may cause the blade to wobble and result in inaccurate cutting.
- Grease vacuum blowers, following the manufacturer's instructions.
- Rotate or flip the cutting surface, as needed.
- Adjust x axis carriage trucks and pinions, following the instructions below.

Every Two Years (or more)

- Replace Lexan cutting surface.
- Replace and adjust x axis and y axis pinion gears, using instructions that follow.

Adjustment Instructions

Adjusting the Carriage Trucks

Tools required:

5/32” Allen wrench
3/32” Allen wrench
1/2” Open-end wrench
Phillips head screw driver
Loctite #222MS

Preparation:

To adjust the carriage trucks, you need to remove the carriage from the table and the support trucks from the end plates.

To Remove the Carriage:

1. Turn cutting machine off.
2. Turn off the air pressure at the control panel.
3. Detach the cables and air lines at the XA and XB ends of the carriage.
4. Remove the XA and XB end caps at the origin end of the table. (The origin end is the end where the (0,0) point is and the where the control panel is located.)
5. Remove the cutting blades, punch, or notch tool from the devices.
6. Using two people, roll the carriage off the origin end.

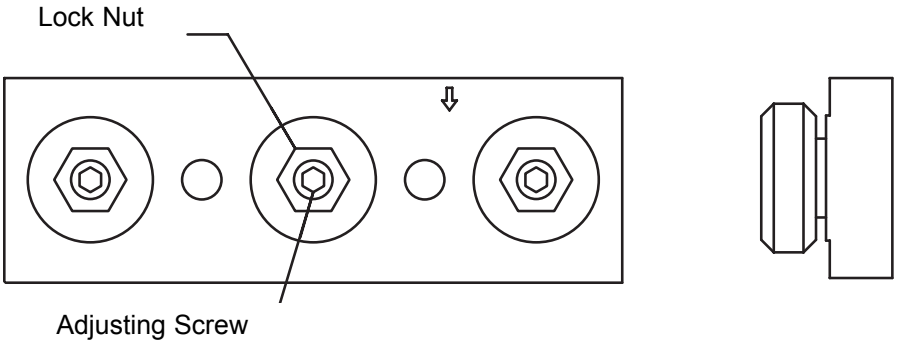
To Remove the Carriage Trucks from the End Plate:

1. Remove the end covers on the carriage.
2. Remove the support truck from the XA side by unscrewing the 3/16” Allen-head truck mounting screws.
3. Remove the support truck from the XB side of the carriage by

sliding it off of the support pins.

Adjustment:

1. Loosen the lock nut on the second and fifth wheels by rotating counter-clockwise while holding the center screw stationary.
2. Place the truck assembly into its track. You may need to rotate the adjusting screw to allow the center wheel to fit into the railway.
3. Rotate the adjusting screw to adjust the tightness of the truck in its track. The wheel needs to be rotated so it moves up toward the top side of the track. When adjusted properly, the truck will not rock in the rail but will move easily.
4. Tighten the lock nut. Push the truck up and down the rail. It should move freely. If not, it is too tight and needs to be readjusted.
5. Reinstall each truck on its endplate, with the arrows pointing down. Leave the Xa side truck loosely attached until you put the carriage back on the table. After mounting the carriage, tighten the truck screws.



Adjusting the Drive Pinions

The x and y-axis motors are mounted on eccentric motor mounts. These enable you to adjust the pinion engagement by simply rotating the motor. Rotating the motors clockwise raises the pinion, decreasing backlash. Rotating them counterclockwise, lowers the pinion, increasing backlash. The goal is to come as close as possible to eliminating backlash, without the pinion engagement being too tight.

Tools Required:

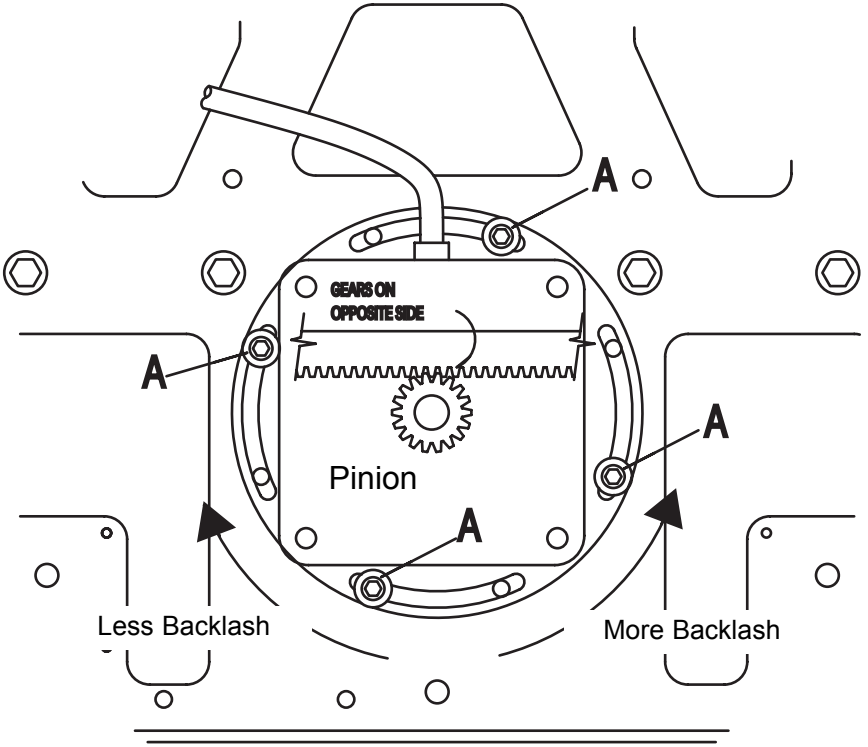
5/32" Allen wrench
Phillips head screw driver

Preparation:

1. Turn off the cutter.
2. Remove the end covers.

To Adjust the Backlash:

1. Loosen the motor mount screws (labeled A), and rotate the motor as far as possible counterclockwise to get maximum backlash.
2. Holding the motor, move the carriage end slightly back and forth. You will feel the backlash clicking as the pinion touches the rack at each end of travel.
3. Still holding the motor in one hand, rotate the motor mount very slowly clockwise, until you can feel the backlash just disappear.
4. Tighten the motor mount screws (A).
5. Check one more time, and then replace the end covers.

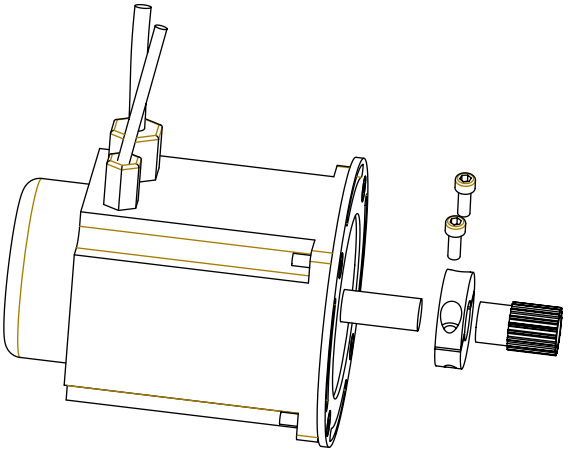

A
GEARS ON
OPPOSITE SIDE
A
A
Pinion
A
Less Backlash
More Backlash

Replacing the Drive Pinions

When your pinions become worn, you can easily replace them. The x and y axis drive pinions are held on the motor shaft by clamping collars.

To Replace the Pinions:

1. Remove the x-motor from the end plate, or the y-motor from the y-cage assembly, by removing the four motor adjustment screws.
2. Remove the worn pinion by loosening the clamping collar and sliding the pinion off the motor shaft.
3. Replace the worn pinion with a new one, and assemble in the reverse order. Make sure the pinion extends beyond the end of the motor shaft by the same amount as the old pinion.
4. Adjust the pinion engagement.



Removing and Replacing the Cutting Head

If any of the device cylinders on your cutting head get bent or damaged, you will need to send it back to Autometrix for repair. Removal of the cutting head is simple. Your cutting head will be returned rebuilt and recalibrated.

Tools required:

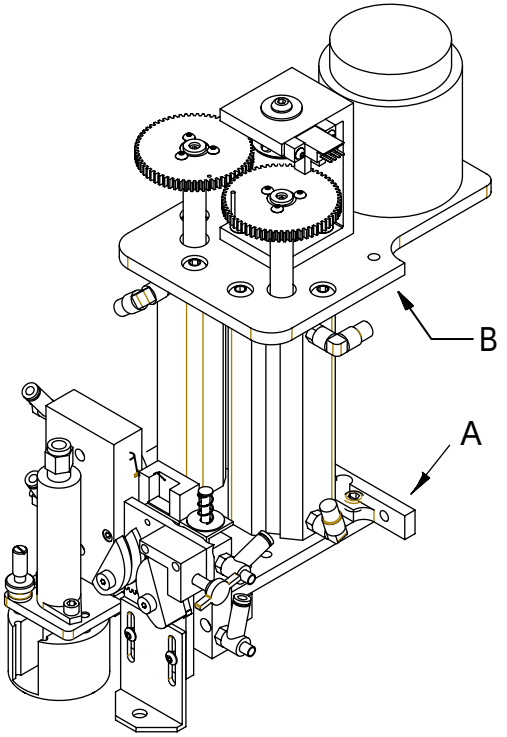
5/32" Allen wrench
Small slotted screwdriver

Preparation:

Before doing any work on the cutting head, turn the power off and remove the power cord from the electronics cabinet. Disconnect the compressed air lines to the machine and remove all the cutting tools.

To Remove the Cutting Head:

1. Disconnect the theta motor wires from the cutting head PC board. Cut any cable ties necessary to remove this wiring harness.
2. Disconnect the theta limit sensor wire by gently pulling the four pin wire connector apart. This will leave four flat pins sticking out of the top of the limit sensor. Be careful to not damage the pins.
3. Mark your air lines with tape or a pen to make sure you reconnect the lines in the proper locations. Then disconnect the air lines from the cutting head at the quick disconnects on the cylinders. Push the outer flange and pull on the tube to remove the line.
4. Remove the bottom two #10-32 cap screws (labelled 'A' in the diagram shown) that attach the cutting head to the rolling cage.
5. Remove the top two #10-32 cap screws that are located on the top cutting head plate (labelled 'B' in the diagram shown).



The cutting head should now be fully separated from the cutting machine. It should consist of two air cylinders, a limit sensor, theta motor with cable, a pen holder, and the three gears on top.

To Replace the Cutting Head:

1. Place the cutting head in position, aligning the top two #10-32 holes in the cutting head with the three threaded holes in the rolling cage.
2. Start the two #10-32 screws into the top of the cutting head.
3. Start the two lower #10-32 screws that attach the base of the cutting head to the rolling cage.
4. Tighten all four screws to approx. 30 in-lbs.

To Connect Wiring and Air Lines:

1. Route the theta motor wire harness around all the moving parts of the cutting head and reconnect.
2. Connect the theta limit sensor wire by gently pushing the four pin wire connector onto the sensor. Caution: this connector will only go on one way so check the direction of the connector and pins to be sure they are aligned. Do not force the connection.
3. Connect the air lines to the appropriate air tool by pressing the tubes into the quick connect fittings.

Recalibration

The theta offset values stored in the controller and used for homing must be updated for the new cutting head values.

1. Note the two numbers on a dot on top of the theta gear. The top number is theta1 and the bottom is theta2.
2. In an editor (such as Notepad or Wordpad), open the usercals file found in your \amx folder.

```
(file:  c:\amx\usercals)

/*  Homing Offsets  */

   2.650          105  set_float   ` cut_x_offset
   0.000          106  set_float   ` cut_y_offset
   0.200          107  set_float   ` cut2_x_offset
   1.900          108  set_float   ` cut2_x_offset
   8.75            13  set_float   ` x_limit_offset
   2.05            14  set_float   ` y_limit_offset
   0.2787          15  set_float   ` t_limit_offset
   0.0040          16  set_float   ` t2_limit_offset
   0.0160          23  set_float   ` xsquare_offset
```

3. Change the theta offsets in the Homing section of the file as shown below. Theta1 is the third from the bottom, and Theta2 is second from the bottom in that section.
4. Save your changes to the usercals file.
5. Start the Motion Mechanic program, also found in your \amx folder.
6. Press the Send key and download the usercals file to the controller.

Complete instructions for Motion Mechanic and controller files are found in Chapter 8: TroubleShooting.

Chapter 8: TroubleShooting

Any problems you encounter can usually be distilled to one of four distinct areas: Software, Electrical or Firmware, Mechanical, and Vacuum.

If you encounter a problem, first write down all of your symptoms and the date when the problem started. We will need as many details as possible. Even though you may have lots of symptoms that don't seem related, the problem usually narrows down to a single component that is not functioning.

Many common problems are easy to solve or avoid.

TroubleShooting Guidelines

Software:

The most common software problems involve communication errors. First, make sure the Ethernet cable is plugged in. Then, start the Machine Tools applet from the Control Panel menu and test the IP address.

If you experience a system crash or a General Protection Fault error, go the the Control Panel, and disable Power Management. This resolves many software problems.

Electronics or Firmware:

The first step in solving apparent electrical or firmware problems is running our diagnostic program, Motion Mechanic. Motion Mechanic usage is explained later in this chapter.
The most common controller problem is a loss of controller memory due to a power fluctuation or spike. If Motion Mechanic reports an "fsp" or "stack" error, reload moparams and usercals as described

later in this chapter.

Mechanical:

Most mechanical problems are easily avoided by good maintenance and by keeping the system clean. Check for:

- tape in the rails
- dust or tape in a limit switch
- badly worn or misadjusted pinions
- sticky device cylinders

Vacuum System:

The most common vacuum problems are caused by

- uncovered holes on the cutting surface
- a leak in the vacuum piping

Diagnostic Tools

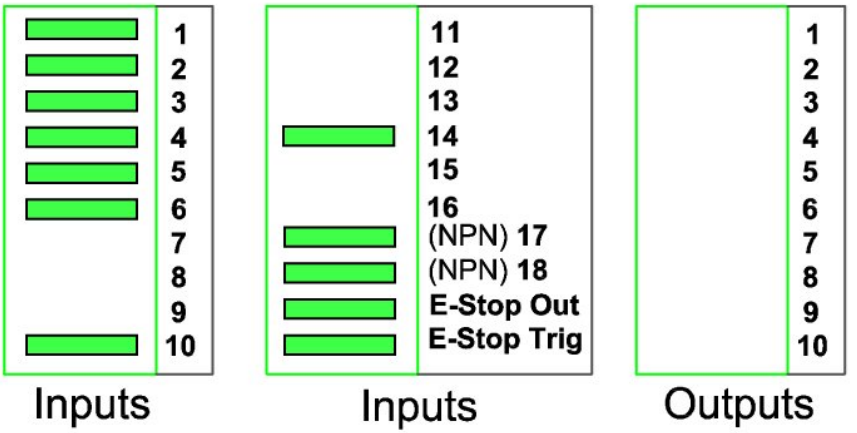
There are a number of different tools you can use as you attempt to diagnose a potential problem.

Controller LED's:

You may need to check the status of input and output devices on the controller PC board. The lights below show the normal startup configuration.

The first six inputs are used for limit sensors. The LED's should be on when not triggered. If a limit sensor is not working properly, or is just dirty, its green LED will be turned off. This lets you easily identify which limit sensors are malfunctioning.

The Pause and E-stop lines should also be on when not triggered.



Inputs:

1 xa low
2 x hi
3 y low
4 y hi
5 xb low
6 theta
7 spare
8 start button
9 spare
10 safety pause

Inputs:

11
12
13
14 ext pause
15
16
17 NPN 1
18 NPN 2
19 estop out
20 estop trig

Outputs:

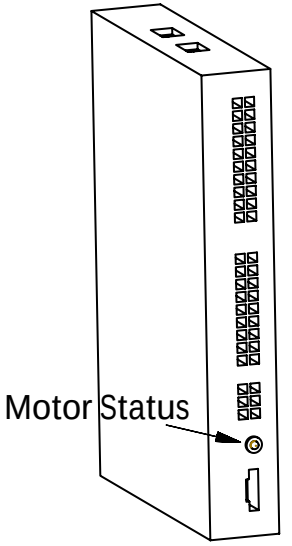
1 pen
2 dev1
3 dev2
4 dev3
5 spare
6 estop light
7 start light
8 pause light
9 blower 1
10 blower 2

All of the output lines are on when active; otherwise, they will be off.

Motor Alarm Lights:

If the PatternSmith Virtual Keypad reports a Motor Fault, you will need to look at the status lights on the motor drives. The type of failure will be indicated by the blink code of the Motor Status light. Blink codes and their meanings are shown on the next page.

Any motor fault will trigger a system-wide emergency stop.



Motor Drive Blink Codes

Blink Code	Drive Status	Meaning	Possible Causes
Rapid	Enabled	Drive is actively servoing	
Solid On	Ready, not enabled	Drive is ready, but not enabled	
3	Over current / voltage shutdown	High input voltage or current sensed	Line voltage high Cable failure
4	Thermal shutdown	Drive temperature exceeds safe limit	EC temp excessive Drive fan blocked
5	Tracking error shutdown	Tracking error has exceeded limit	Mechanical problem Cable problem
6	RMS shutdown	Motor torque requirement too high	Mechanical problem Cable problem
7	Encoder signal problem	Drive detected illegal encoder state	Encoder problem Grounding problem
8	N/A		
9	Communtation signal problem	Drive detected illegal hall sensor state	Hall failure Cable problem
10	ADC failure		Drive failure
11	EEPROM needs initializing		Needs configuration file reload
12	EEPROM hardware failure		Drive failure
13	Vector setup error	Error detected at startup	Hall failure Drive problem
14	Current Sensor fault		Drive failure

Using Motion Mechanic for Diagnostics

Motion Mechanic is a diagnostic tool that lets you communicate directly with the controller of your cutting system. You can use Motion Mechanic for intercepting error messages and for downloading init files and calibration files to the Controller. Motion Mechanic is most frequently used by tech support members at Autometrix to diagnose a problem.

Starting Motion Mechanic

Motion Mechanic is already installed on your tablet PC at your Control Console. You can use the desktop icon to access Motion Mechanic, or you can open it from the Start menu. Before you open Motion Mechanic, make sure that your cutter is turned on. When you open Motion Mechanic, the first thing you will see is a dialog box.

Currently Installed Machine Tools
Please select the Machine Tool you wish to communicate with from the list below. If your Machine Tool is not listed, it can be added by selecting the "Machine Tools" icon from the Windows Control Panel.
Default Machine
MC (9020)
MultiCam1
OK
Cancel

This box lists all your currently installed machine tools and asks you to pick one to communicate with. You may only have one installed machine tool. Select your tool and click OK.

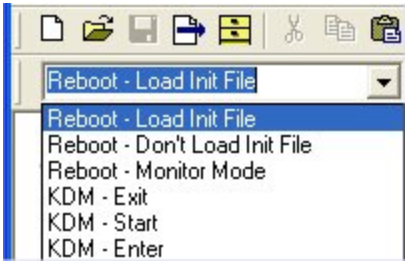
Send File / Store File / Reboot

Now you will see the Motion Mechanic screen. There are three primary tools you will use in Motion Mechanic: Send File, Store File, and Reboot.

The Send File button, found on the toolbar, allows you to send the information in a file of your choice to the Controller. Clicking this button opens a file selector box. Use this selector to find and send moparams or usercals.

The Store file tool reloads your init files into the Controller's memory. Use this button to store an init file into a specific location of memory. In the file selector box, first use the bottom dropdown menu (controller location) to select one of three options: file location 0, firmware, or user init file. Choose the location for the file based on the file type (keypad files should be stored in file location 0, init files in user init, and firmware in firmware. What you select from this dropdown menu will change the extension file type shown.

The final tool you will use in Motion Mechanic is the Reboot function. Reboot from the dropdown menu box in Motion Mechanic.



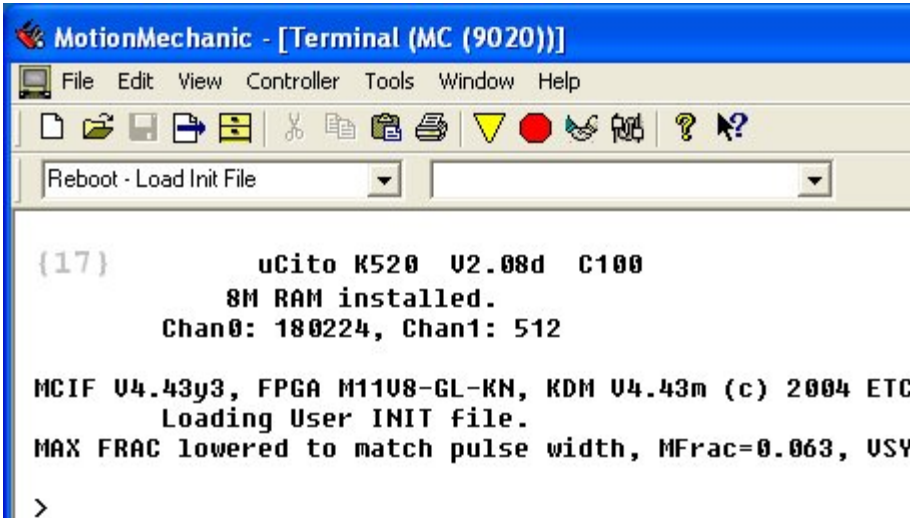
This restarts the Controller, erasing memory in the process.

The Main Screen

The main screen in Motion Mechanic is used to relay messages from the Controller. You can type on the screen; you will not see your own typing, but after pressing Return you will see the Controller's response. Alternatively, you can type in the dropdown to the right of the Reboot dropdown.

When troubleshooting, it is often convenient to see your commands echoed in the top portion of the screen. You can see an echo by typing batch_off to make the text appear as you type. To stop the echo, simply type batch.

To be sure that your computer is communicating, you can type 'junk' and press Enter. The controller should respond with a message 'Error 2: Token 'junk' not found'. (Error messages are written in red.) If it doesn't respond, your computer is not communicating. Check your cables and then go back to Machine Tools to test the IP address.


MotionMechanic - [Terminal (MC (9020))]
File Edit View Controller Tools Window Help
Reboot - Load Init File
(17) uCito K520 V2.08d C100
8M RAM installed.
Chan0: 180224, Chan1: 512
MCIF V4.43y3, FPGA M11V8-GL-KN, KDM V4.43m (c) 2004 ETC
Loading User INIT file.
MAX FRAC lowered to match pulse width, MFrac=0.063, VSY
>

Testing Limit Switches

To see if any limit switches are triggered, type the command:

lchk

The controller will return a number indicating which limits are triggered:

0	none
1	LOWXA
2	HIX
4	LOWY
8	HIY
16	THETA
64	LOWXB

If more than one limit is triggered, the number will be a sum of all the limits in the 'on' state. You can also see the status of limit switches by looking at the controller inside the electronics cabinet at the first six LED's on the Inputs LED bank near the center of the controller (labelled on the diagram shown).

Testing Motors

Before testing any motors, you will need to bypass the homing process at Startup. You can do this by sending the command:

no_home

Next, change to motion mode instead of jogging mode by sending the command:

start_plot

Finally, you can send motion commands in the form:

<x> <y> <theta> ualine ep

Fill in any values for x, y, and theta, in inches. The carriage will move to that location.

Retrieving Calibration Values from the Controller

Retrieve all of your calibration values from the controller by pressing F2, creating a file name, and sending the command:

upload_params

Rebuilding Flash Memory

If you see 'fsp' or 'stack' errors in MM, you may need to rebuild part of the controller memory. Init files and calibration data are stored in non-volatile (flash) memory on the controller. In certain instances of power failure, you may lose some of the flash memory and need to reload it from the hard disk. The files that make up the controller memory are found in your c:\amx folder.

m2521-404.uc	Init file with homing and motion routines.
vkdm5c.ini	Init file with keypad routines.
Moparams	Motion parameter data.
Usercals	User calibration data.

In addition to the init and data files, the controller needs low level firmware that can be reloaded. Check our website for the current firmware version.

To rebuild controller memory, Start MM and the X5. From the dropdown, select Reboot - Don't Load Init and press Enter.

The following steps are in order of severity of the problem. Start with number 1, reloading moparams and usercals. If that doesn't fix the problem, go on to number 2, reloading the init and kdm files. Reboot again, and if the problem persists, continue with 3 and possibly 4.

1. Reloading Moparams and Usercals files:

Press the Send button and navigate to your \amx folder.
Select the file ‘moparams’ and click ‘Open’.
Press the Send button again and navigate to the \amx folder.
Select the file ‘usercals’ and click ‘Open’.
From the Reboot dropdown, select Reboot - Load Init File and press Enter.

2. Reloading the init and kdm init files:

(Call Autometrix first for the name of the current init files)
Press the Store File button. In the bottom dropdown in the dialog box, select File Location 0. Navigate to the file vkdm5c.ini and press Open.
Press the Store File button again. From the bottom dropdown in the dialog box, select User Init. Navigate to the file m2521-404.uc and press Open. The controller will reboot itself after loading the files.

3. Reformatting the controller memory:

This will only need to be done in extreme circumstances, when a power problem has caused extensive loss of memory integrity in the controller. Always call Autometrix before you do this.
To remove the init files,

type format_files

To remove the data parameters

type format_params

You will not see any response to these commands.
After you reformat, do steps 1 and 2 above.

4. Rebuilding the firmware:

In extreme cases, you may need to rebuild the firmware in the controller. Please call Autometrix for the latest file.

Symptoms, Causes, and Remedies

Electrical/ Electronic Problems

A. Problems during Power On

1. No response, no lights, no keypad display

Possible Causes: What to Do:

No power to the EC	Check the power indicator light on the EC Check the power disconnect near the cutter Check the Facility circuit breaker Check other 220v equipment
Blown fuse in EC	Check the fuse in the drawer above the power cord

2. No keypad display (dark)

Possible Causes: What to Do:

No power to KDM	Check the 15 pin connector on the back of EC Check the 5v and 12v at the keypad Check the 12v at the EC
Loose Connector	Check connecting plug to KDM
Broken or disconnected wire to KDM	Check continuity on all wires at KDM

3. Keypad displays Version but no Press Home message

Possible Causes: What to Do:

Loss of part of controller flash memory	Start Wmx95 program Watch for parameter errors or fsp stack errors: if so, reload moparams and usercals.
Voltage to Controller low	Measure voltage, adjust to 5.00v
Broken or disconnected wire to KDM	Check continuity on all wires at KDM
Emergency Stop active	Check EStop button (should be out) Start Wmx95 and check for Halt function Check motor drives in EC for red lights
Com port error at EC or KDM	Call Autometrix

4. Keypad displays Press Home but no 'Local' LED on keypad

Possible Causes: What to Do:

Loss of part of controller flash memory	Start Wmx95 program Watch for parameter errors or fsp stack errors: if so, reload moparams and usercals.
Voltage to Controller low	Measure voltage, adjust to 5.00v
'Local' LED is burned out	Press Find Home to see if it is just the LED
E-Stop is active	Check E-Stop button (should be out) Check E-Stop wiring for continuity
Motor drive failure or broken motor wire	Check EC for any red lights on Drives

5. Keypad displays “Limit Detect” message

Possible Causes: What to Do:

Debris in one or more limit switches	Check all of your limit switches for debris. Blow out with an air nozzleand try turning the cutter on again.
Broken wire to limit switch or broken switch	Start Wmx95.program Turn the cutter off, count to ten, then back on. Watch for error messages (in red). Type ‘lchk .’ (leaving a space between ‘lchk’ and ‘.’) to see which limit is active, then check the wire for that switch.
Carriage may be sitting on a limit switch	Turn cutter off, move carriage by hand, then turn back on.

6. All LEDs are lit, and KDM display is dark

Possible Causes: What to Do:

Broken or shorted wire at KDM	Remove end cover and check wires to KDM Check ribbon cables from keypad
Low voltage at KDM	Check voltage at EC and KDM.

7. Pen or cutter drops when cutter is turned on

Possible Causes:	What to Do:
Broken relay (on/off switch) on Controller	Open the EC and check the lights on the Opto22 relays. Swap two relays to see if the problem shifts to another device.
Shorted wire	Check continuity on wiring to solenoid valves

8. Motor doesn't lock up

Possible Causes:	What to Do:
Broken cable	Check drives in EC for alarm lights Check motor cables
Motor Drive Failure	Check drives in EC for alarm lights Swap drives (call Autometrix first!)

B. Problems during Homing

1. Nothing happens

Possible Causes:	What to Do:
Home button not working	Start WMX95 and watch boot-up process Try homing from Wmx95 by typing 'find_limits' Replace keypad, if necessary
E-Stop active	Check E-Stop Check motor drives for alarm lights
Motor cables are loose	Unplug and replub motor cables Clean motor cable connectors
Problem with drive disable circuitry	Return electronics cabinet to Autometrix
Incompolete startup of controller	Strt Wmx95 and watch boot-up process

2. Carriage moves in wrong direction

Possible Causes:	What to Do:
Corrupted data in controller memory	Reload moparams and usercals through Wmx95
Damaged chip on controller	Swap chips in U21/U22 on M40 I/O board to test; replace chips

3. Carriage moves away from home after homing

Possible Causes:	What to Do:
Broken wire to joystick (fast motion)	Remove end cover and check wiring
Joystick out of adjustment (slow motion)	Adjust joystick potentiometers
Damaged KDM or joystick	Call Autometrix

4. Keypad says ‘Homing Y Axis’ but no motion occurs

Possible Causes:	What to Do:
Emergency Stop active	Check EStop switch
Dead IC on interface board	Return electronics cabinet to Autometrix

C. Joystick Problems

1. Works but does not have three speeds

Possible Causes:	What to Do:
Joystick is out of adjustment	Remove end cover and adjust joystick potentiometers

2. Can't move carriage in one or more directions

Possible Causes:	What to Do:
Broken wire between KDM and joystick	Check continuity between KDM and joystick
Failed Joystick or KDM	Check output of joystick and replace either joystick or KDM as required

D. Pause and EStop Problems

1. Pause doesn't work

Possible Causes:	What to Do:
Pause switch broken	Tie pause lines together to see if problem goes away; if so, replace pause switch.
Controller Error or bad chip	Swap chips in sockets U14 and U17 to see if problem moves

2. Pause without touching pause button

Possible Causes: What to Do:

Broken wire	Check continuity of pause signal in steps all the way back to controller
Dirty or damaged switch	Test switch for continuity
Electronic noise or interference	If you can press 'Start' to get it started again, noise is the most likely cause
Loose screws on pause button	Tighten screws and test

3. E-Stop doesn't work

Possible Causes: What to Do:

Short in EStop cable	Check continuity of EStop signal in steps all the way back to controller
Dirty or damaged switch	Clean and test switch for continuity

4. E-Stop without pressing E-Stop button

Possible Causes: What to Do:

Broken EStop cable	Check continuity of EStop signal in steps all the way back to controller
Motor alarm on drive	Check alarm lights on motor drives
Disconnected at plug	Check connection at Electronics Cabinet

E. Machine Stops while running

1. PatternSmith displays Com (or Unknown) Error message

Possible Causes:	What to Do:
Broken or loose host serial cable	Check connection and continuity
Com port buffers set too high	Set both transmit and receive buffers to lowest setting
Com port handshake failure at computer	Replace com port in computer

2. PatternSmith displays Limit Detect message

Possible Causes:	What to Do:
Debris or material in a limit switch	Blow out limit switches and test
Failed limit switch	Swap another switch and see if problem moves; replace limit switch
Failed Opto chip at controller	Swap opto chips in sockets U10-U13 and U17 and test
Loose connector at limit switch	Unplug and replug limit switches and test

3. PatternSmith displays Out of Bounds Error message

Possible Causes: What to Do:

Error in pattern perimeter	Make sure perimeter encloses all of the pattern
Com port error sending bad data from computer	Replace com port and test
Wrong setup parameters in PatternSmith	Check setup parameters Go to Plot>Plotter Setup>Table Size

4. Random Pause Detect

Possible Causes: What to Do:

Breaking or broken cable or switch connection	Check for loose screws on pause switches Check continuity of pause signal in steps all the way back to controller Test switch
External electronic noise	If you can press 'Start' to get it started again, noise is the most likely cause

5. Random Estop while running

Possible Causes: What to Do:

Breaking or broken cable or switch connection	Check continuity of pause signal in steps all the way back to controller Test switch
External electronic noise	Eliminate other possibilities such as broken cable, or motor drive

6. Carriage stops and KDM displays ‘Press Home’

Possible Causes: What to Do:

Breaking cable causing a short	Test continuity of all signal (not motor) cables
Failing power supply	Monitor power supply voltage while running

Mechanical problems

A. Cutting Head

1. Pen or cutter won’t drop or lift (from keypad)

Possible Causes: What to Do:

Blocked air supply	Check needle valves (pen only) With air off, check for free motion With air on, push red button on solenoids Remove cutting head cover.
Failed relay	Check Opto22 relay on controller
Keypad or KDM failure	From Wmx95, test circuits by typing ‘2 0 1 pset_bits’
Communication failure between controller and KDM	Test wiring continuity

2. Pen or cutter won't drop or lift (while running)

Possible Causes: What to Do:

Sticky cylinder or low air pressure	Check air pressure. Use one drop of sewing machine oil on cylinder shaft Check air regulator
Broken wire to solenoid valve	Test solenoid valve with red button on top Check light on Opto22 relay Test continuity of wiring
Opto relay failure	Check light on Opto22 relay for operation
Solenoid valve problem	Test solenoid valve with red button on top of valve Check for clear air supply

3. Pen Drop/Lift Speed

Possible Causes: What to Do:

Sticky cylinder	Try a very small amount of sewing machine oil on cylinder shaft
Needle valve setting	Open needle valve all the way, then readjust

4. Pen stays down

Possible Causes: What to Do:

Sticky cylinder	Try a very small amount of sewing machine oil on cylinder shaft
Needle valve setting	Open needle valve all the way, then readjust

5. Pen to Cutter offset

Possible Causes: What to Do:

PatternSmith setup parameter	Check PatternSmith2000 instructions
Motor stalling	Are all of the pen/cutter offsets consistent? If not, there could be a motor stalling someplace on table

6. Slow action on cylinders

Possible Causes: What to Do:

Sticky cylinder or low air pressure	Try a very small amount of sewing machine oil on cylinder shaft
Bent cylinder shaft	Turn off air pressure, and move cylinder by hand

7. Wobbly blade

Possible Causes: What to Do:

Loose axle bolt	Replace axle bolt periodically
Worn spacers	Replace blade spacers periodically

8. Unusual blade wear

Possible Causes: What to Do:

Theta calibration error	Check theta calibration
Loose blade	Check for correct spacers, worn axle, correct assembly
Abrasive material being cut	Replace blade more often Try using different style blade
Excessive air pressure	Don't use more than required for material; check blade sharpness

B. Losing position

1. Carriage losing perpendicular

Possible Causes: What to Do:

Loose pinion collar	Tighten collar clamp and test
Excess rolling resistance causing motor stall	Turn off power, and make sure carriage rolls easily everyplace on the table Test all bearings
Debris in rack	Clean rack and retest
Low AC input voltage	Test input voltage

2. Losing position on any axis.

Possible Causes:	What to Do:
Loose pinion collar	Tighten collar clamp and test
Excess rolling resistance causing motor stall	Turn off power, and make sure carriage rolls easily everyplace on the table Test all bearings
Debris in rack	Clean rack and retest
Low AC input voltage causing motor stalls	Test input voltage (in brown-out condition, machine won't run reliably)

3. Losing position on first table, OK after warmup.

Possible Causes:	What to Do:
Loose pinion collar	Tighten collar clamp and test

4. Motor stalls

Possible Causes:	What to Do:
Excess rolling resistance causing motor stall	Turn off power, and make sure carriage rolls easily everyplace on the table Test all bearings
Cutting very heavy material	Try slower speeds Consider high torque motor option (call Autometrix)
Loose pinion collar	Tighten collar clamp and test
Debris in rack	Clean rack and retest
Low AC voltage	Test input voltage

C. Motors

1. Motor feels hot

Possible Causes:	What to Do:
One or more broken wires	Check all motor wires for continuity
Improper setting on drive	Check motor drive switch settings

2. Motor sounds rough

Possible Causes:	What to Do:
Missing one phase of 3 phase power	Test input power Check wiring of motor (only for new installation)

Vacuum problems

A. Vacuum Blower

1. Blower is slow getting to speed, then trips breaker

Possible Causes:	What to Do:
Missing one phase of 3 phase power	Test input power Check wiring of motor
Magnetic starter failure	Test mag starter
Low setting on magnetic starter	Check current setting on mag starter (call Autometrix first!

2. Blower trips breaker after some time

Possible Causes: What to Do:

Pinion adjustment or worn pinion	Replace pinion and adjust backlash
Broken wire in cable	Test continuity of motor cables
Drive settings	Check drive settings
Motor bearings	Power off, remove carriage from table, and move motor by hand

B. Vacuum Table

1. Low vacuum pressure

Possible Causes: What to Do:

Bleed valve setting	Close bleed valve, then reset to get 95 inches water
Too many open holes in surface	Cover open surface with plastic and test again
Cutting surface not seated against gasket	Check gasket condition

2. Not holding material down

Possible Causes: What to Do:

Porous material	Cover with plastic and test
Bleed valve setting	Close bleed valve, then reset to get 95 inches water
Clogged holes in cutting surface	Clean or replace cutting surface
Too many open holes in surface	Cover open surface with plastic and test again

Chapter 9: Calibration Guide

Carriage Square Calibration

In PatternSmith, create a square 51 inches on each side. Set the device to Pen for plotting. Put wide paper on your cutting table, and plot the square you just created.

Measure each diagonal as accurately as possible. Diagonal 1 (d1) refers to the upper left to lower right line. Diagonal 2 (d2) is the lower left to upper right line. If everything is in calibration, each diagonal will measure 72.125 inches. If the carriage is out of square, one diagonal will be greater than 72.125, and one less.

You can compute the amount to correct the Xsquare_Offset using the following formula:

For 60 and 63 inch systems:	delta = .0065 * (d1*d1 – d2*d2)
For 72 and 73 inch systems:	delta = .0075 * (d1*d1 – d2*d2)

Next, use any text editor (Notepad or Wordpad) to open the UserCals file found in the folder called c:\amx.

Look for the Homing Offsets section, which reads:

```
/*  Homing Offsets  */
    2.650     105  set_float   ` cut_x_offset
    0.000     106  set_float   ` cut_y_offset
    0.200     107  set_float   ` cut2_x_offset
    1.900     108  set_float   ` cut2_x_offset
    8.75       13  set_float   ` x_limit_offset
    2.05       14  set_float   ` y_limit_offset
    0.2787     15  set_float   ` t_limit_offset
    0.0040     16  set_float   ` t2_limit_offset
    0.0160     23  set_float   ` xsquare_offset
```

The bottom line in the example on the previous page shows a value of 0.0160, stored in location 23 as xsquare_offset. Add the delta value you computed (above) to the value you find on that line, and replace it. Save the UserCals file.

Start the Wmx95.exe program found in the \amx folder. Press the F1 key to download a file, and download the UserCals file you just modified.

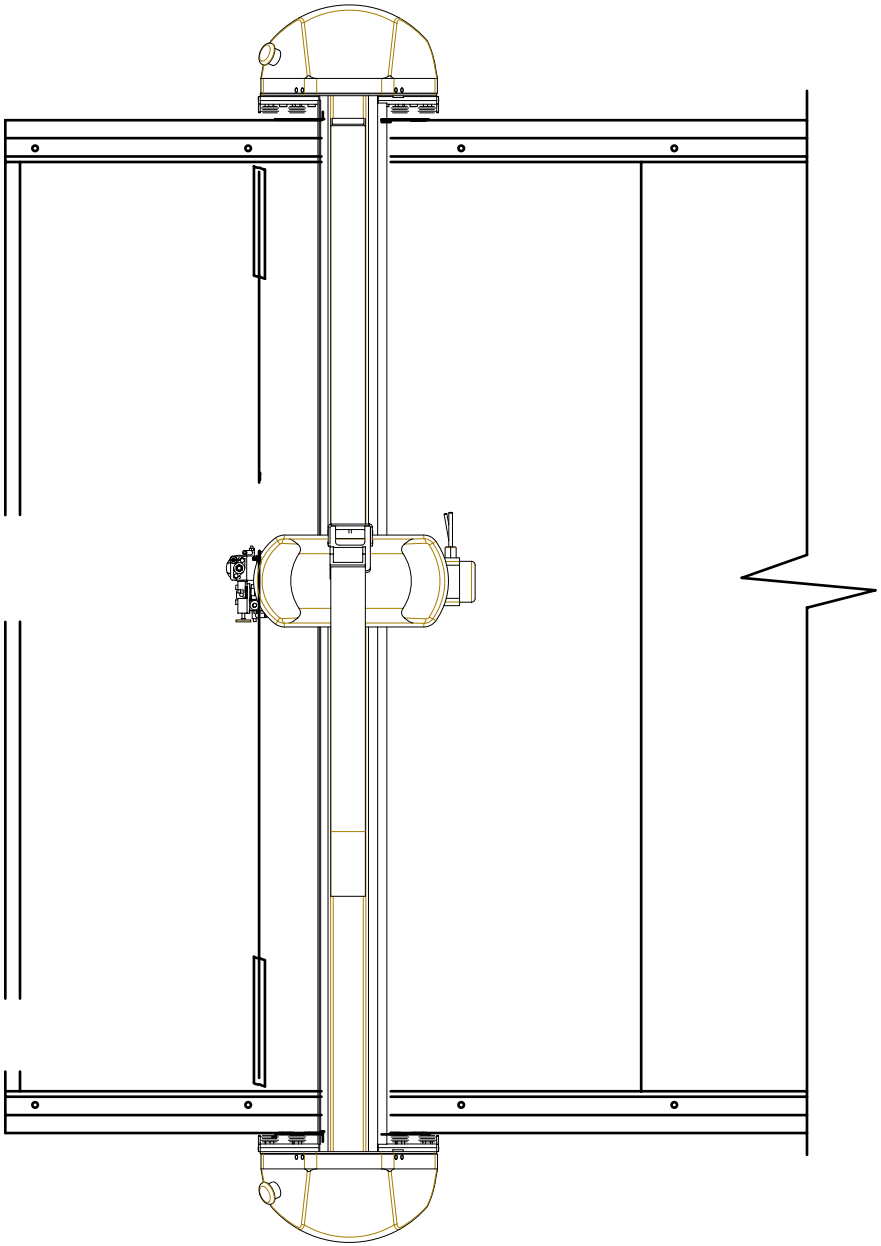
Still in Wmx95, type COLD to restart the controller, home the carriage, and repeat the process until the diagonals are accurate. The error in perpendicular is about half the difference between the diagonals.

Theta Axis Calibration

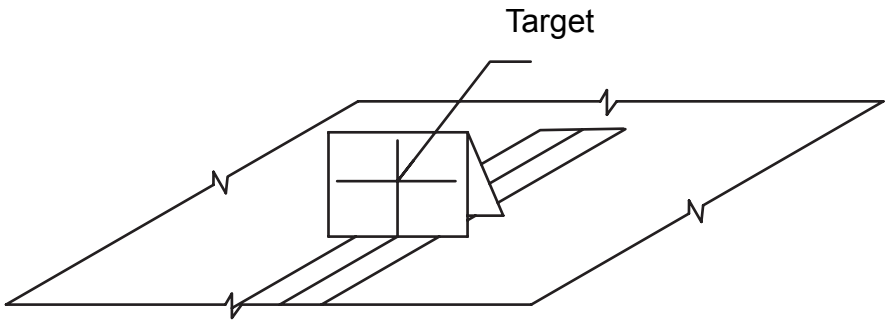
1. Put about 8 inches of masking tape on the table at the origin, at the near and far sides, as shown below.

2. Use the pen on the carriage to draw a line all the way across the table so that it crosses both tape strips, while it is at a constant value of x. It is important to jog only in the y direction, so check your x location at the start and end to make sure it didn't move.

3. Press your laser pointer on a block of modelling clay, switch side up. The laser should be horizontal, about 1 inch above the table surface. Place the pointer on the far side of the table, aligned with the line drawn on the tape. Turn on the pointer and direct it toward the tape line on the near side of the table.



4. Use a folded piece of paper with drawn lines as a target for the laser pointer. Make sure the laser is directly above the line at both ends (use a square to be sure).



5. Attach the rolling blade holder to device 1. Using a strip of double-sided mylar adhesive, attach a small mirror to the side of the holder away from the keypad. Make sure the mirror is pressed on flat or the calibration will be wrong.

6. Jog the carriage until the cutting head is near the keypad side of the table, and the mirror on the blade holder is reflecting the laser pointer beam back toward the laser. The reflected beam should be within 0.25 inches of the laser. If it is not, you will need to adjust the calibration.

Adjusting the Theta Calibration Value:

In your UserCals file, look for the Homing Offsets section:

```
/*  Homing Offsets  */
      2.650    105  set_float   ` cut_x_offset
      0.000    106  set_float   ` cut_y_offset
       0.200   107  set_float   ` cut2_x_offset
      1.900    108  set_float   ` cut2_x_offset
      8.75      13  set_float   ` x_limit_offset
      2.05      14  set_float   ` y_limit_offset
      0.2787   15  set_float   ` t_limit_offset
      0.0040   16  set_float   ` t2_limit_offset
      0.0160   23  set_float   ` xsquare_offset
```

The third line from the bottom in the example above shows a value of 0.2787 stored in location 15 as t_limit_offset. The value is the fraction of one revolution required from the limit sensor to align the theta axis perfectly. You will start with the value shown in your usercals file, modify it, and then put the new value into the usercals file and the controller.

With the Cutter turned on, start MotionMechanic and make sure you have communication. Then, type the following commands exactly as shown below:

```
batch_off
0.0 == T_LIMIT_OFFSET
start_plot
find_t_home  (This will home the theta axis with zero offset.)
#set_origin    (This resets the current location to home.)
0.  0.  t1value  ualine  ep
```

Start with a t1value equal to the value in your usercals file, since that should be close. Continue changing the value for t1value until the beam is reflecting back to within 0.25 inch of the laser (on the left side viewed from the keypad).

```
tvalue == T_LIMIT_OFFSET
```

This will change the homing offset to the value you have just determined reflects the laser beam correctly.

```
find_t_home          (homes theta axis with new offset)
```

Continue changing the tvalue in very small increments (about 0.0003) and homing until the beam reflects perfectly. The final value is your new theta 1 offset.

Enter the new theta 1 offset value in your UserCals homing offsets section for location 15. Save the UserCals file. In MotionMechanic, send the modified UserCals file to the Controller. Reboot the Controller, home the carriage, and check your Theta offset.

Adjusting the Theta 2 Calibration Value:

In MotionMechanic, type end_plot to allow jogging. Move the blade holder (with mirror) to the second device. Jog the carriage so the laser beam hits the mirror and reflects back to the laser. Then type:

```
start_plot
batch_off
#set_origin
0.  0.  t2value  ualine  ep
```

Continue changing the value in t2value until the laser beam is aligned. That is your new theta 2 offset. Copy that value to the UserCals file on the line below the theta 1 offset, storage location 16. Save the UserCals file and send it to the controller as before.

Adjusting the Theta Calibration Value (Using Calibrate):

Theta One

1. Start the Calibration program.
2. Open 'Align Theta One' form
3. Press 'Home Theta with 0 Offset' to home with no offset and set origin
4. Press 'Start Jog' to use right/left arrows to move theta position
5. Pressing 'End Jog' will allow you to jog using the joystick
6. Press 'Home Theta with New Offset' to check the new offset
7. When satisfied with new offset, click 'Set New Offsets' (form closes)

Theta Two (Theta 2 is set relative to Theta 1)

1. Open 'Align Theta Two' form
2. Press 'Home with No Offset' to home Theta 2 with 0 offset from Theta 1
3. Press 'Start Jog' and use right/left arrows to move Theta2
4. Press 'End Jog' to manually jog the carriage
5. When satisfied, press 'Set New Offsets' button (form closes)